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The Journal

OF THE

EAST AFRICA AND UGANDA NATURAL HISTORY SOCIETY

MARCH 1916 VOL. V. No. 9.

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C. W. HOBLEY, C.M.G.

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Photo by Sir F J. Jackson.

NEST OF THE LAKE VICTORIA LUNG FISH.

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1916

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ILLUSTRATIONS

AFRICAN LUNG FISH

By Sir F. J. Jackson

Two photographs of the nests of the lung fish are forwarded, in the belief that they may prove of interest to the readers of the Journal.

The Central African Lung Fish (*Protopterus Ethiopicus*) is known to the Baganda as 'Maruba,' and is very plentiful in the Victoria Nyanza. It is often seen on a calm day when the water is quite smooth, with its nose and part of its head protruding above the surface for the purpose of breathing, and occasionally it opens its mouth as if it were in the act of yawning.

In August of last year I came across the two nests in question, situated in a vast swamp at the head of a bog near Entebbe. This swamp runs for many miles inland, and it separates the island of Bussi from the mainland. Across it there is a channel of open water some twenty-five feet in width, cut by the natives and kept open by the daily canoe traffic with the island. The water in this channel is only two to three feet in depth, but the mud formed by rotting vegetation is so deep that the bottom cannot be reached with a pole ten feet long. In a small canoe it is possible to paddle and push with a forked pole to almost any part of this swamp. With caution and the aid of a pole, it is even possible to wade about in it, but the occupation is too distracting for nature study, and it is not to be recommended. Irishmen would, I believe, readily admit that walking a quaking bog is child's play to it.

The nests were evidently of recent construction. They were both situated in a patch of coarse grass, were circular in shape, with a diameter of about two and a half to three feet, and about eighteen inches in depth. The water within the circle was quite clear. The sides were vertical, and were, no doubt, retained in that position and prevented from subsiding by a matted network of the fine grass roots. On the roots there

was a deposit of fine mud particles, so susceptible to the slightest movement of the water, caused by inserting the hand, or even a reed, that it became turbid and prevented further observation. The most remarkable features of the constructions were the outer rings of mud. These were raised about an inch above the water level, and were about four to five inches in width, and had more the appearance of being the work of man than a fish. The mud did not appear to have been pushed up from below, but to have been deposited from above and then smoothed down, the surface being firm and shiny. It is, I believe, not impossible that the mud was brought to the surface in the mouths of the fishes, and then smoothed down by their flattened, slimy, eel-like tails.

ENTEBBE, *May* 1914.

THE ALLEGED DESICCATION OF EAST AFRICA

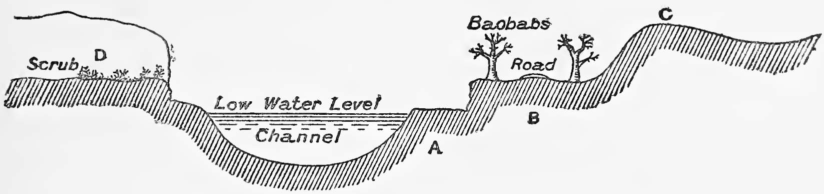
BY C. W. HOBLEY, C.M.G.

This question has been the subject of considerable verbal discussion in the country itself, but very little has been written on it. The evidence for the alleged desiccation of the globe was, however, the subject of a recent learned paper by Prof. J. W. Gregory in the *Geographical Journal* for March 1914, and it has occurred to me that it would be useful to record the evidence on the subject which has come to my notice in British East Africa and other places on the east side of the continent.

Generally speaking, it is believed that very marked evidence is available that considerable desiccation of this part of the continent has taken place from late Tertiary times down to the present day. To commence at the coast, it is undoubtedly the fact that the whole of the coast-line from the German border to, say, Kismayu shows undoubted signs of elevation in recent times. Take Mombasa island, for instance; one there finds the recent coral reefs raised to a height of 70 feet

above sea-level, but at the entrance to Kilindini harbour (Mombasa) there is more than that: on the island, some 200 feet back from the edge of the present coral cliff, there is another cliff which evidently marked the width of the channel in, say, Pleistocene times; in the opposite direction a third cliff is just emerging from low water level.

Now, I believe that it can be safely asserted that the width of a channel through a coral barrier usually depends on the amount of fresh or semi-fresh water discharged through it, the mixture of fresh water with the salt checking the growth of the reef. I therefore believe that when the cliff marked C was the boundary of the tidal channel, the volume of fresh water discharged into the upper waters of the harbour was



Section of entrance to Kilindini Harbour

much greater than it is to-day; similarly, when the cliff B bounded the water-channel, the volume of fresh water was greater than at present, when a new cliff A is being formed which can be clearly seen at low tide. The greater volume of fresh water would also bring down mud which is generally recognised as being a factor that checks the growth of coral. This theory is borne out by the large amount of erosion which is visible in the cañons of the Mwachi and Manolo rivers, which even now in flood-time discharge a considerable amount of fresh water into the head of Port Reitz. The amount of fresh water, however, at any season bears a very small proportion to the enormous volume of salt water which flows into and out of Port Reitz and Kilindini harbour. The Andromache reef and the reef to the north of the port correspond in age to the semi-submerged cliff A, which is just showing above sea-level.

At the time when cliff C formed the north boundary of

the channel, the reef marked D was awash and in the same position as the Andromache reef to-day, the south wall of the sea channel being further back. At Shimoni station, opposite Wasin, there are large underground caves in the coral rock, the ramifications of which extend a considerable distance; in one of the caves there is still a tiny brackish spring, and this gives a clue to their formation, for, as far as I can judge, they can only have been formed by the presence of springs of fresh water which bubbled out at sea-level, and wherever they occurred prevented the coral insect from working in the vicinity; the volume of these springs gradually decreased, and the coral insect built over the top, leaving these winding galleries through the heart of the reef. The springs have now almost disappeared.

As we proceed north up the coast we obtain evidence of another character and of more recent times. The coast-line from Wasin to Kismayu is studded with ruined towns. South of Mombasa they do not appear to be so common as to the north, although there are quite a number to be found in the dense bush along the coast-line at Shirazi and immediately south of Mombasa island. Immediately north of Mombasa there are ruins at various places between Mombasa and Malindi, notably at Kilifi, Gedi, and Mida; near Malindi itself there are traces of large settlements, and again at Shesheli, Ngomeni, and on towards Lamu. Between Kismayu and Port Durnford there are said to be sixty miles of coast full of ruins, and again north of Port Durnford and on the islands of the north portion of what is called the Lamu archipelago there are innumerable ruins of stone buildings, absolute evidence of a dense population. No record remains of these people, but they are commonly supposed to have been early Persian settlers, and the settlements seem to have been formed since the establishment of the Mohammedan religion, for there are numerous remains of well-built stone mosques with the typical Moslem Kiblah (or shrine) on the north side towards Mecca, ruined arches, myriads of stone graves of the Moslem type, and so forth.

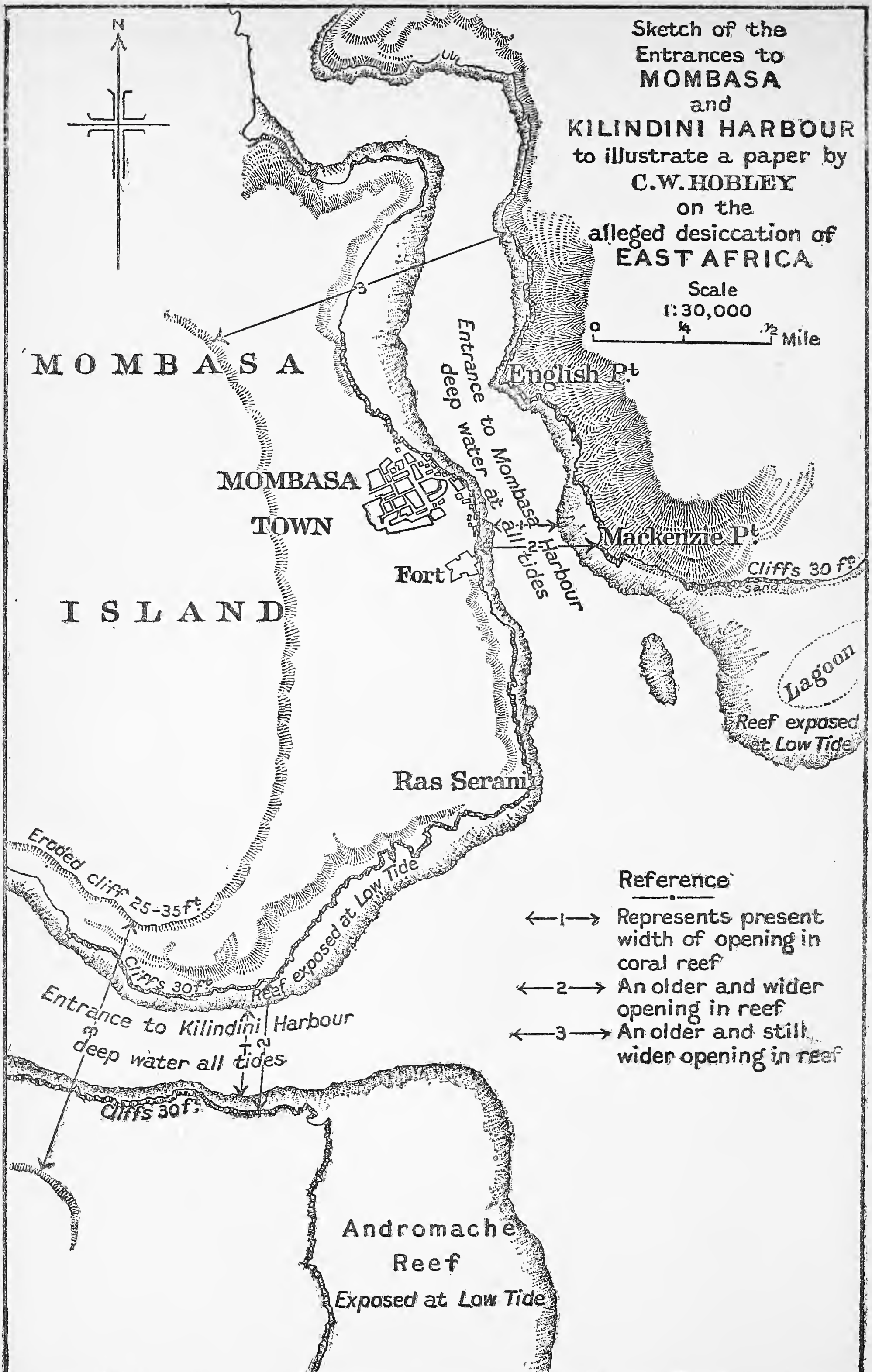
Only careful excavation can, however, settle who these people originally were; we have no record of the foundation

Stone Cairn on Tana River, between Thaka Country and Korokoro; the Top of the Cairn is Concave.

(*E. Battiscombe, photo*, 1909.)

of such extensive Arab settlements as this, and I am inclined to believe that they may date back as far as Himyaritic times, and be an offshoot of that great civilisation which built the huge dam at Mareb in South Arabia and excavated the Aden tanks. There is some reason for the belief that the tribes of the interior were influenced at a remote period by Semitic beliefs, pre-Mohammedan in point of time, and this influence may have emanated from these settlements; the Mohammedan mosques and graves being products of the culture superimposed by Arab conquerors. In some places, if we examine the maritime plain in the vicinity, the limits of their cultivated fields can be seen, for land which has been cultivated for a considerable period and then abandoned carries a different flora from land covered by primeval bush or forest; but wherever I have had the opportunity of examining the area of the previously cultivated strip, it would not prove a *raison d'être* for the presence of the old population.

Now, knowing the congestion of the average Eastern settlement, there is no doubt that the population which built these towns must have been very considerable, and the question arises as to what they were doing there, and what they were living on. Presumably the glib reply will be that they were trading for ivory, apes, and peacocks. The ivory trade probably was considerable; but I imagine that the apes and peacocks did not figure very largely in their Customs returns, to say nothing of the fact that the peacock is an Asiatic bird, although some ingenious commentator has suggested that the term 'peacock' really referred to the African guinea-fowl. I am inclined to believe that these settlements really thrived on the cattle and live-stock trade with the tribes of the interior, and for the following reason. In the Somali hinterland there are also evidences of a much greater population, and it is highly probable that they were great pastoral people, for the country is naturally not an agricultural area, but pre-eminently a stock country. Around Wajheir, in Jubaland, to-day, large numbers of artificial mounds are to be found, many of them as much as thirty feet in height, and these are, it is believed, the funeral mounds of an extinct race. The Hon. K. Dundas opened one of the smaller ones. He found a few fragmentary



Sketch of the Entrances to MOMBASA and KILINDINI HARBOUR to illustrate a paper by C.W. HOBLEY on the alleged desiccation of EAST AFRICA
Scale 1:30,000
0 ¼ ½ Mile
N
MOMBASA
ISLAND
MOMBASA TOWN
Fort
English Pt
Mackenzie Pt
Entrance to Mombasa Harbour deep water at all tides
Cliffs 30 ft
sand
Lagoon
Reef exposed at Low Tide
Ras Serani
Eroded cliff 25-35ft
Cliffs 30ft
Reef exposed at Low Tide
Entrance to Kilindini Harbour deep water all tides
Cliffs 30ft
Andromache Reef
Exposed at Low Tide
Reference
←1→ Represents present width of opening in coral reef
←2→ An older and wider opening in reef
←3→ An older and still wider opening in reef

bones, unfortunately no human ones, but he discovered what appears to be a rude copper bracelet; as there is no copper found naturally in that country, this betokens trade and intercourse with the coast, and with people who had copper to sell.

These mounds are so numerous, and in addition the large number of well-excavated wells, often over forty feet deep, and the traces of artificial dams, all go to prove that this area, which is now practically a desert, once carried a large and organised population. It is now only inhabited by a limited population of nomad Somalis, who move about from waterhole to waterhole and graze their stock as long as the water lasts. Similar mounds are found throughout the Nyika belt as far south as Taru, on the Uganda railway, but south of Wajheir they become much smaller, and rarely average more than a few feet in height.

The Somalis say that the wells and the mounds were made by the Maanthinle people. This name in the Somali language means the tall people; possibly they consider that people who carried out such works must have been of superhuman stature.

In the evidences of the population of the hinterland we have, it appears to me, an explanation of the settlements on the coast; and as to their disappearance, I put this down to the desiccation of the country. There is no record of these settlements having been systematically destroyed by invasion, and even if the coast dwellers were annihilated, it is difficult to see how the tribes of the interior could have been exposed to similar attack.

We know that in about the year 1589 a terrible horde of savages, called the Mazimba, swept up the east coast and destroyed Kilwa and nearly destroyed Mombasa; this force swept on up the coast, but were, according to the records, finally defeated at Malindi by Mattheus Mendes de Vasconcellos with a number of Portuguese soldiers, the Arabs, and some 3000 Bantu tribesmen recruited in the vicinity and said to be Wa Segeju. This invasion may account for the comparative scarcity of ruins south of Mombasa, but it cannot account for the abandonment of the settlements between Lamu and Kismayu. The trade of these coast settlements was, I believe, the supply of domestic animals for meat during the south-west

monsoon, to the, at that time, comparatively dense population in South Arabia.

In connection with the presumed desiccation of the country west of Lamu and Kismayu I may mention the drying up of Lake Stefanie. When Count Teleki and Höhnel visited it in 1888 it was a definite lake of large dimensions; when Donaldson Smith visited it in 1884 it was rather larger than in Teleki's day; but of recent years it has become little more than a big puddle holding a certain amount of water during the rains. I do not, however, attach great importance to this evidence, as it extends over too short a period of time. Never having visited Lake Rudolf, I cannot adduce any direct evidence as to whether it exhibits traces of desiccation, but one fact strikes one, and that is that the Teleki volcano at the south end of the lake, which was very active in 1888, is now quite extinct, and this, I am inclined to think, may be due to the recession of waters of the lake, as the steam generated by the infiltration of lake water may have afforded motive power for its eruptions.

To change the scene of our inquiry, let us proceed up country for a little. There are undoubted evidences of the greater extent of Lake Naivasha within geologically recent times; Prof. Gregory, too, gives evidence as to the existence of a great lake he names after Prof. Suess, in the Rift valley, south of Naivasha; Lake Magadi is, I believe, the attenuated relic of a sheet of water of much greater extent. Mr. J. Parkinson, in his paper in the *Geographical Journal* (July 1914), has shown that in post-Pliocene times Lake Magadi was once a sheet of water of much greater extent than the area covered by the soda deposits at the present day, and he further states as follows: 'Evidence is afforded by this district, *i.e.* the Rift Valley, of a general desiccation: the periodical floods of the Turoka river are not adequate for the formation of such a gorge as that now seen, and we have in addition the disappearance of Lake Suess. The old alluvial fans of Lorgosalich, now overgrown by vegetation, point to torrential rains being more frequent at an earlier period.'

Lake Nakuru probably once also extended much further to the south than it does to-day. There is little doubt that

the Lakdera river, which is the dry watercourse which emerges from the east end of Lorian swamp, and which can be traced down to the Deshek Wama lake and so to the Juba river, was once a real river and a tributary of the Juba; nowadays it can hardly be called a river except for the fact that water can be found in wells at certain places along its course, and thus there is an underground seepage of water which is fed from the Uaso Nyiro after every rainy season. The Lorian swamp, too, turns out to be much smaller than was originally reported, but of course the original reports were very vague. Deshek Wama lake only carries water once in every few years, and that is almost certain to be either surface water from the surrounding country or flood water from the Juba.

If, as is believed in times past, the Lakdera was a considerable river with a belt of thick forest on its banks, this might have exercised some small effect on the climate of the surrounding area. Jilore lake, near the Sabaki river, which was quite a considerable sheet of water up to recent years, has been steadily diminishing, and is now quite dry, and the site is covered with scrub. This may, however, be due to the Sabaki river, which fed the lake to a great extent, having cut its channel below the level of the inlet to the lake. Baratumo lake, on the south of the Sabaki river between Jilore and Malindi, is also said to be now dry.

Proceeding west over the Mau escarpment we descend to Lake Victoria, and there we find definite evidences that that lake once extended eastwards as far as Muhoroni, roughly 400 feet above the present lake-level, and it was probably the waters of the lake which, converted into steam, afforded the motive power that broke down the crater wall of the great volcano now called Tinderet. I doubt if this fall of the level of Lake Victoria is entirely due to the wearing away of the sill of the natural dam formed by the granite dyke at Jinja, known as the Ripon Falls; I am inclined to believe that the decrease in rainfall has had a greater effect.

The German authorities inform me that Lake Rukwa at the south-east corner of Lake Tanganyika has much decreased in size during the last fifty years, and that the western portion of it has practically disappeared and become swamp; they also

state that the marks of the old water-levels on Lake Nyasa are now many feet above the present water-level. This may, of course, be due to the wearing away of the sill where the Shiré river leaves the lake. To go further afield, we know that in Livingstone's day Lake Ngami was an open sheet of water, and is now nothing more than a swamp; but these examples may be considered too remote from the area under consideration to be of any weight. According to the Duke of Mecklenburg, the salt lake of Katwe in South Toro is drying up, and the salt deposits may be seen several yards above the present lake-level. This is probably due to desiccation in historic times, as sodium chloride is such a soluble salt.

One must exercise great caution in an inquiry of this kind to separate evidence of a geological character from evidence of what may be termed an historical character, because in dealing with the two classes of evidence one is thinking in different terms. It must be borne in mind that our accurate meteorological records in these parts of Africa only go back some twenty-five years, and in that period no great decrease of rainfall is marked. The evidence of the coast settlements above quoted goes back probably some six hundred years, and may go back much farther, for, as has been mentioned, it is possible that they date back to the zenith of the Himyaritic civilisation in South Arabia; the fact that there are ruined mosques may not prove that these erections were coincident with the foundation of the settlements. For all this, however, there is a great jump from historic times to the later Tertiary age, when the Rift valley was in an unstable condition owing to volcanic disturbance, but there is nothing to show that the conditions which set in then have not continued up to the present era.

After having stated a problem it is always considered advisable to propound a plausible solution, and it is here that I fear I shall fail to satisfy the critic. There are, however, a few points in this connection which should be set forth. One is the great decrease of the area under forest in the higher parts of East Africa, particularly in the Kikuyu region, *i.e.*, the south-south-west slopes of Kenya and on the Aberdare ridge, during historic times. Owing to the increase of population

and the consequent greater demand for agricultural land during the last hundred to two hundred years or so, it is estimated that the area of forest has artificially been decreased by some 3000 square miles. The rain-borne clouds sweep westward over the continent, and when chilled by the belt of forest on the higher ridges deposit their rain on the western slopes; this would afford a reasonable explanation of a decrease in rainfall in a certain portion of the Rift valley during that period. It would, however, afford little explanation of the desiccation of the hinterland of Jubaland between Kismayu and Lake Rudolf.

Another point which has been suggested is that the rate of elevation of the interior of British East Africa has been in excess of the rate of denudation, so that in effect the rainfall has run off so quickly that it has not had time to permeate the soil of the area on which it falls; this point is, however, I consider, without any support. There is definite evidence that the glaciation over Mount Kenya extended in Pleistocene times to a much lower level than it does at present, and there is little doubt that this state of affairs had a considerable effect on the climate of a great portion of this part of Africa; or, to express it more logically, that the conditions which produced a more extensive glaciation on Kenya also considerably affected the climate of the country generally, and the lower general temperature of this part of the continent would probably cause greater precipitation of rain. As Professor Gregory, however, points out with great acumen, the coastal raised beaches and reefs give no palæontological evidence of contemporary reduction in the temperature of the adjacent ocean.

Prof. Gregory found traces of former glaciation on Kenya over 5000 feet below the present lowest terminal level of the ice, and he goes on to argue that this was due to a much greater elevation of the Kenya area. The present peak of Kenya is the denuded core of a volcano which probably at one time presented a dome-like shape somewhat on the same lines as the Kibo peak of Kilimanjaro; the sister peak of Kilimanjaro, Mawenzi, may be said to be in the same stage of decay as Kenya. Mawenzi is about 2000 feet lower than Kibo, and so we can, for the purpose of argument, add 2000 feet to the height

of Kenya and obtain a rough estimate of its original altitude; the extra area of the ice-fields under these conditions would doubtless partially account for the traces of glaciation at a lower level.

Dr. Rocatti, the geologist to the Abruzzi expedition, observed traces of glacial action on that mountain on the east side, at 4870 feet above sea-level; the lowest level of the existing ice is now about 13,680 feet, an astounding recession of 8780 feet. The climate at the time this vast area of snow-field existed on mountains like Kenya and Ruwenzori must have been extraordinarily unlike present-day conditions.

The botanical evidence available, however, shows that a more or less common alpine flora is to be found on all the high mountains from Abyssinia to Kilimanjaro, and this flora is quite unlike anything to be found in the intervening country. This fact tends to show that at one time, and, speaking geologically, at a not very distant period, there was a continuous connection of land at a high level between these points so remote. Gregory estimates that at that time the mean temperature must have been at least 17° lower than at present. Now the prevailing winds on the coast are the north-east and south-west monsoons, which blow periodically parallel to the coast in one direction or the other according to the seasons. Up country, at an elevation of a few thousand feet, the changes in the monsoon are not felt, but over the bulk of the year a strong wind, generally easterly and a little south of east, blows during the greater part of the day, and it is believed that these are the trade winds blowing high over the monsoon winds which keep near coast-level. It is very marked on the big mountains in the interior, such as Kenya, Kilimanjaro, and Elgon; in the early morning they are generally quite clear, but about 10 A.M. the clouds sweep up from the south-south-east and collect on the mountains and blot them out from view for the rest of the day. These are believed to be clouds borne inland by the trade winds, and the moisture they carry is precipitated mainly on the south and south-east slopes; the proof of this precipitation exists in the much greater growth of forest on the south and south-east sides of the mountains referred to. Now, when there was a continuous ridge of high land between

Abyssinia and Kilimanjaro this precipitation must have been enormous, and an enormous amount of water must have flowed eastwards towards the Indian Ocean.

Prof. Gregory also produces arguments with regard to the effect of the variation of lines of atmospheric pressure which would be caused by the greater elevation of a large area, and which he claims would greatly increase the rainfall and widen its distribution. I am, however, inclined to doubt whether the information as to the position of the isobaric lines, *i.e.* lines of equal barometric pressure, is sufficiently accurate to build upon, although this would of course not necessarily affect the principle of the argument.

Several other explanations have been adduced by geologists to account for periodic variations in climate, and variations in rainfall would follow. One of these, which has from time to time attracted considerable attention, is that the main contributory cause is the variation in the carbonic acid contents of the atmosphere. There is little doubt that in earlier geological times the proportion of free carbonic acid gas was much greater in the atmosphere than at present; all the great coal deposits of the world are built up of carbon from the atmosphere, and it is alleged that the enormous deposits of limestone in the Earth's crust, which contain many times more carbon than all the coal deposits put together, although primarily they obtained their carbon from the sea, absorbed a great portion from the air. The evidence, as far as it goes, appears to prove that the oceans are the greatest governors of the proportions of carbonic acid gas in the atmosphere, and it is calculated that an increase of 0·06 of carbonic acid gas in the atmosphere would cause a rise in the average temperature in the Polar Regions of some 14° Fahr., the idea being that a reduction in the carbonic acid gas contents cools the climate and an increase causes the reverse.

Now, extensive volcanic action is known to produce vast amounts of carbonic acid gas, but the great volcanic activity of Pleistocene times does not seem to fit in altogether with the greater extent of the Kenya glaciers about that period. I believe, however, that extensive volcanic activity is usually attended by temporary torrential rainfall, partly due to the

condensation of great masses of steam, and this would probably dissolve the greater portion of the extra free carbonic acid gas. Thus taking every factor into consideration, the most hopeful course would appear to be to search for some cause to account for a gradual change in the routes of atmospheric circulation. The usual cause for such variation is a different distribution of land and water; in this case, however, there appears to have been no change that can count.

I am not enough of a meteorologist to say whether there are any other theories as to why the monsoons or trade winds should have carried less moisture over the continent during historic or recent geological times, but the evidence remains as I have stated it, and my only hope is that someone may be able to pursue the question a stage further and produce some logical explanation of the problem I have endeavoured to expound.

EXPERIMENTS IN HAWKING

By W. F. B. Bryant, C.E.

Some eighteen months ago, on the Magadi Railway, finding myself amongst many different species of hawks and being very much interested in these birds, I resolved to try to train them, to see what use, if any, could be made of them.

Having spent some time in watching their habits, I found that all of them invariably fed on rats and mice, and took little or no notice of small birds. This was not encouraging, as they spent their time sitting idly on trees and falling on their food in a clumsy sort of way that would in time spoil them for any clever quarry.

However, since they were so keen on rats, I used these for bait. The hawks came down and took them without any hesitation, but, do what I would, I could not catch them in the horse-hair nooses I set round the bait. They seemed to see them and alight on the ground about two feet away, and creep in without danger and carry off the prize.

I do not exaggerate when I say that I had at least six different kinds of hawks sitting in different trees waiting for me to put down rats for them.

This state of things, however, did not last for ever, and I tried the native trap used for birds, composed of the well-known bent stick snare, which is kept set by means of a small twig which, when moved, releases the spring, the bird being caught round the leg with a running noose.

The first bird I caught was very similar to the European goshawk. She had a dark-brown back, speckled breast, and was pure white under the wings. She was, as far as I could judge, about the same size as a female goss. Her talons were a little stronger and longer than those of the goss, but the head and eyes seemed exactly similar to those of the European bird.

Having had good sport in Ireland with a goshawk, I was hoping that this bird would also turn up trumps, and perhaps she would have done so had I had time to devote to the matter.

Having got my hawk, I had to set about breaking her in. I first cut a 'boy's' blanket into long strips, which I wound round my wrist and forearm to enable me to handle her better. I had previously made jesses and slipped these on, pulled the leash through and tied her up to her perch, which was padded slightly on the top and had an empty sack hanging down and tied at the two bottom corners to the ground. The object of this sack was that, should she try to fly and fall down, as she naturally would to the end of her leash, she could climb up the stout sacking back to her perch.

At first she was very wild and would not eat, but at the end of the third day she took a live mouse and ate it whilst I stood in front of her. After this she rapidly became quite tame, and at the end of ten days looked for my coming and would let me handle her.

All this time I had fed her on rats and mice, but now I tried birds. The first pigeon I gave her did not interest her much, and until I had cut it open and half plucked it she did not seem to know that it was food. After this she plucked the birds herself and was very keen on them. She took longer to learn that a Guinea fowl was also good to eat.

Having got 'gossy' quite accustomed to her surroundings, I began her training. My first care was to train her to come to me from her pole in the middle of the camp. She was tied to the pole by a cord about thirty feet long, and I would stand about ten feet away and hold out a fresh pigeon. She would get very excited, but would not leave her pole, so I had to go a trifle nearer—in fact approach until she left her pole and flew to my hand. When she did come I used to let her eat off my wrist. Continuing, the same method was employed until she did not hesitate to come to my hand up to a distance of forty yards.

My next experiment was to let her go free. She immediately flew up into a tree and began to look round for food. When I showed her a pigeon she came straight down from the tree to my hand; in other words, her training should then have been completed. However, when I took her out to hawk wild Guinea fowl she did not fly at them, expecting, I suppose, to find one that had already been killed and half plucked for her. This showed that she was not used to killing these birds, and I should have had to spend considerable time in teaching her how to hunt. As this is harder than the first training and takes more time, I was reluctantly compelled to give it up.

I feel quite certain that this bird would prove very useful if a little trouble were taken with her, had one the time to devote to it.

Whilst training this goshawk I caught several other species. One was a light grey kestrel with pink eyes, which was useless except for rats and mice. Also a little brown hawk, the size of a merlin, with which I could do nothing as far as small birds were concerned, it feeding chiefly on mice, grasshoppers, &c. On the other hand, I caught a beautiful hawk, dark brown all over, a good deal larger than the British sparrow-hawk, but very similar. With care this bird should prove good, but she is very timid and cannot be treated as roughly as the goshawk. She is very fast, and should kill anything.

Another bird I caught was of a grey colour on the back, with speckled breast, long yellow legs, yellow eyes, and having a black bar across the wings which showed in flight. I have

seen this bird take a pigeon on the wing and have heard of her killing Guinea fowl, but this is exceptional, and the common food seems to be rats and mice. Probably, if rats were not so common, these hawks would prey on birds, as their talons are very strong and were never made for mice. However, for the little time this grey hawk was in my possession, she gave me the impression of being very useful, but inclined to be slow and not to take enough trouble to try again should she miss her first stoop.

It must be understood that I had but little time at my disposal for this sport, and have only been able to make these few observations, but anyone taking the matter up more thoroughly and spending more time will, I am sure, be rewarded.

I have seen falcons passing overhead, but have not caught any, so am not in a position to make any remarks about them.

REARING AND TAMING OF WILD BIRDS

By Dr. V. G. L. van Someren, M.B.O.U.

The subject introduced by Mr. Seth-Smith in the 'Uganda Note Book' is a very wide one, and one of absorbing interest.

I have, during the past two years, taken a great interest in the rearing and taming of wild birds. At different times I have had birds belonging to thirty-five different species—ranging from a Pelican to the small Finch commonly known as the 'animated plum.'

Mr. Seth-Smith mentions the Barbets. These, in my opinion, are exceedingly difficult to rear and keep, although one would not think so. I have had both young and adults, and the longest time any one of these lived with me was a fortnight. This was an adult caught off one of its sleeping-holes. I cannot account for this difficulty, for, as far as my experience goes, the chief food of Barbets consists almost entirely of insects and fruit, and the birds I kept were given a sufficient quantity of food and ate well. The mere fact that

they were confined seemed to have an adverse influence on them, and they appeared to droop from the first day.

I can corroborate Mr. Seth-Smith's observation on the tameness of these birds. Several pairs nested in my garden last breeding season, and at one of the nesting-holes I was able to procure several photographs of the adult birds. I stood alongside the camera, which was not more than three feet from the nest.

I must say, however, that tameness is not a common trait amongst nesting birds in this country. Sir Harry Johnston, in a review of a recent publication of ours—'Bird Life in Uganda'—remarked on the tameness of birds out here, and expressed surprise that the collection of photographs did not include some of the well-known species. I doubt whether the reviewer ever attempted to take photographs of birds at close quarters in this country. If he had, I am certain that he would have altered his opinion in a very short time.

Returning to the subject of Aviaries, the following is a list of those species which I have kept, and which, with the exception of those marked with an asterisk, have done quite well :—

Hyphantornis Spekei
H. Reichenowi
H. Fischeri
Vidua principalis
Penthetria laticauda
Serinus striolatus
Estrelda phœnicotis
E. rhodoparia
**Neisna nyanzœ*
Lagnosticta brunneiceps
**Spermestes cuculata*
**S. nigriceps*
Pycnonotus Layardi
Coracias caudatus
Lanarius humeralis
Corvus affinis
**Barbatula sulphurosa*
Lamprocolius chalybeus
**Anthus trivialis*
**Lucinia lucinia*
Elanus cœruleus
Turtur semitorquatus
T. damarensis
Tympanistria tympanistria
Chalcopelia chalcospilos
Francolinus Granti
F. Schuetti
F. Hubbardi
Pternistes infuscatus
Coturnix Delagorguei
Limnocorax niger
Balearica gibberieceps
Pelecanus roseus
Strix flammea
Pœocephalus massaicus.

The list is fairly comprehensive, and contains most of the common birds which one would meet round Nairobi.

If one wishes to keep wild birds it is certainly false policy to have small cages. Those I have found most useful measure 10 feet long by 8 high and 4 deep. These cages, built on a veranda where there is plenty of sunlight and a fresh current of air, seem to suit the birds better than those outside. In any case the cages ought to be roofed, because of the intense heat of the sun and the heavy tropical downpours of rain which one has to contend with.

The wire mesh should be small, not more than ½ inch, for in places frequented by genets or mungooses it is fatal to use wire of larger mesh, for through it they are able to kill and tear to pieces even large birds the size of a partridge. I have lost several in this way. Partridges and doves seem to have an extraordinary attraction for genets and mungooses.

One end of the run should be screened off on the outside, from about half-way up the sides reaching to the roof, to provide shelter from wind and driving rain. The floors should be well lined with gravel and sand, which should frequently be changed. Plenty of fresh water is absolutely necessary.

A few notes on different species of birds and their food may not be amiss.

Weavers do very well indeed. They are active and extremely interesting, and if not overcrowded will nest readily. They become tame quickly and are easily fed, doing best on a mixture of 'mwele,' a seed not unlike canary seed, matama and whimbi, and occasionally fruit, especially papaw. They are very fond of raw maize, greens such as lettuce, and chickweed.

The same food does for the smaller finches except those of the *Spermestes* and *Serinus* genera, which have to have plenty of fresh grass seeds.

To compensate for the loss of insect food I found it best to give finely minced raw meat once a week and larvæ of bluebottle flies, 'maggots' when obtainable.

Most birds are fond of white ants, and when these are abundant they should be given frequently.

As singing birds, the yellow-vented bulbul, *Pycnonotus Layardi*, and some of the *Cossyphæ* cannot be excelled, and

these can be kept easily, feeding them on fruit, bananas, berries, maggots, and minced meat once a week. Too much meat makes the birds pugnacious and scraggy in plumage.

Doves make good pets, but many folk object to them as they are not very active and spend most of the day preening themselves. As objects of beauty, however, I think it would be hard to beat the pretty green-spotted dove, *Chalcopelia chalcospilos*, or the white-breasted dove, *T. tympanistria*. The former has a note somewhat like *T. semitorquatus*, but much softer and more plaintive.

For colour, the long-tailed roller, *Coracias caudatus*, is an excellent bird, so also are plantain-eaters and glossy starilngs. They are all easily kept.

All the birds mentioned so far are perching birds; to complete the runs one must have some ground birds, and one cannot do better than to procure a few Quail. *Coturnix Delagorguei*, a common species in the Kavirondo country, does splendidly. Those I have had for over a year have nested and laid several eggs, but owing to the crowded condition of the runs they did not sit.

A good bird of a different build and appearance is the little black crake, *Limnocorax niger*. These become tame in a very short while, and will readily feed from the hand. The drawback to keeping them is that one must have plenty of water, running if possible, and plenty of cover, such as long grass. With these the feeding is more complicated, but I found they did quite well on minced raw meat, boiled maize flour to which raw meat juice had been added, and maggots. The food was taken best if put in at the head of the stream and allowed to drift down with the flow of the water.

Francolins do well, but one really requires a large run to do them justice. They are best reared from eggs hatched under fowls or young birds in their first season. Adults do not tame easily, and, besides damaging themselves, frighten any other birds there may be in the run.

The most amusing bird I have kept is a pelican. It was obtained fairly young, just able to fly, and has been in my possession for nearly two years. It is fed on three pounds of

raw beef-steak per day. It is perfectly tame, and wanders all over the grounds and through the house.

The chief causes of death amongst aviary birds are pneumonia, avian tuberculosis, constipation through over-eating, and anæmia. If any bird shows signs of either of the former it should at once be removed.

THE ORGANIC CELL

Part IV.—Its Methods of Division and Status in the Process of Heredity

By E. Wynstone-Waters, F.R.S.Edin., &c., *Late Senior Demonstrator of Anatomy at the Royal College of Surgeons, Edinburgh.*

Mitotic cell-division ensures the continuity of life, and maintenance of the species, by passing on from cell to cell a counterpart of the chromatin which was the determining factor in its own organisation.

Cell-division runs in cycles, with a continual loss of energy. Rejuvenescence only occurs after the addition of material derived from the nucleus of another cell. The operation which results in this admixture is called fertilisation, and is the essential factor of sexual reproduction. The result of the fresh admixture of nuclear material is twofold :—the energy of cell-division is restored, and two separate lines of descent become fused in one. The actual reason why this double process should take place is unknown. One school of thinkers, represented by Herbert Spencer and Hertwig, believe that protoplasm shows a strong tendency to pass into a state of very stable equilibrium, and that in order to render it more responsive the addition of fresh nuclear material is necessary.

It has been pointed out that the life-history of the Metazoan is a parallel to that of the Protozoan, for in both of them, after a series of cell-divisions, a period of senescence sets in, which can only be prevented by conjugation. After conjugation

there is a period of rejuvenescence, in which the functions of cell-division and growth are fully restored.

In parthenogenesis, however, the egg develops without fertilisation, and from this fact it is extremely difficult to decide whether a tendency to senile decay, and the necessity for fertilisation, are necessary properties of living matter.

The other teaching may be termed the Variation Theory. According to this view fertilisation is necessary to the production of variations, on which the process of natural selection can operate.

Both theories are in unison with the work of practical breeders, which shows that crossing results in greater vigour and variability.

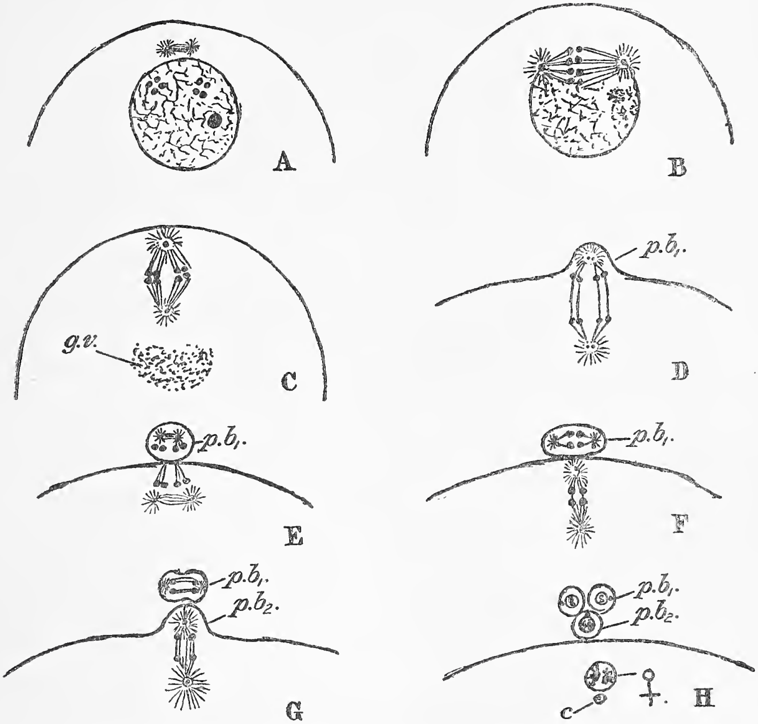
As the time of fertilisation approaches, the nucleus of each cell contains its full supply of chromosomes; it is therefore evident that if some of these bodies are not got rid of the number of chromosomes would be doubled during each generation. As a matter of fact, however, it has been proved beyond a doubt that during the period of maturation there is a reduction of the number of chromosomes to one half. It is also certain that this reduction of chromosomes in the male and female germ-cells is a process preparatory to their subsequent union. Thus, when the male and female cells unite, the normal number of chromosomes for the species is restored. It will now be necessary to examine very briefly this complicated process.

Reduction in the Female.

Each primordial germ-cell, by the usual mitotic type of division, gives rise to a number of cells called oogonia. These divide for a certain number of times, and then cease. Each develops into an ovarian ovum, the nucleus increasing very considerably in size to form the Germinal Vesicle, the cytoplasm becoming loaded with food material. The egg-cell remains in this state until the time of fertilisation approaches, when the process of chromatin reduction occurs. Two minute cells develop near the upper pole of the ovum, and as a rule one of these further divides into two. Thus a group of four cells arises, the mature egg and three small cells which are called polar bodies; the polar bodies take no further part in develop-

ment, but die. They must be regarded as merely rudimentary eggs, which have forfeited their right to live, for the common good of the permanent ovum.

The case described below is that of *Ascaris*, the facts having been made out by Van Beneden and Boveri.

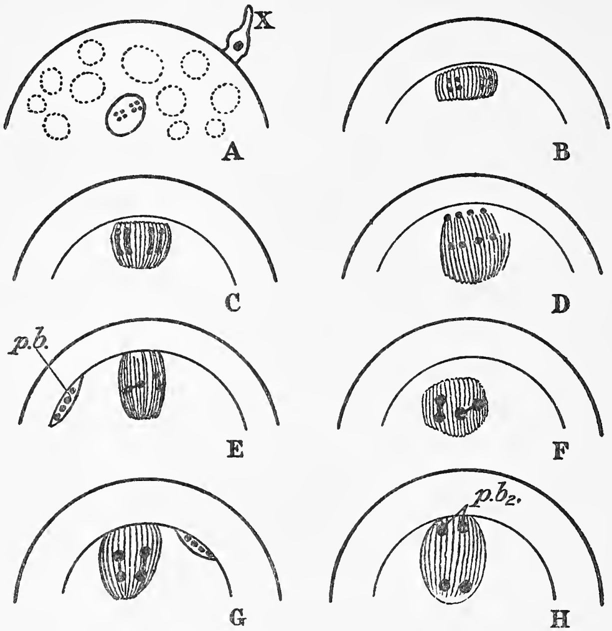


Diagrams Illustrating the Maturation of the Egg. The Somatic Number of Chromosomes is supposed to be Four.

A. Initial phase; two tetrads have been formed in the germinal vesicle B. The two tetrads have been drawn up about the spindle to form the equatorial plate of the first polar mitotic figure. C. The mitotic figure has rotated into position, leaving the remains of the germinal vesicle at *g.v.* D. Formation of the first polar body, each tetrad divides into two dyads. E. First polar body formed; two dyads in it, and two in the egg. F. Preparation for the second division. G. Second polar body forming, and the first dividing; each dyad divides into two single chromosomes. H. Final result; three polar bodies, and the egg-nucleus (♀), each containing two single chromosomes (half the somatic number); *c.* the egg-centrosome which now disappears.

As the egg gets ready for the formation of the first polar body, the chromatin in the germinal vesicle (nucleus of ovum)

arranges itself into masses, each mass divides into a group of four bodies which are connected by linin threads, forming what is known as a tetrad. The number of tetrads is always one half the usual number of chromosomes. In *Ascaris* two tetrads appear in the germinal vesicle, the normal number

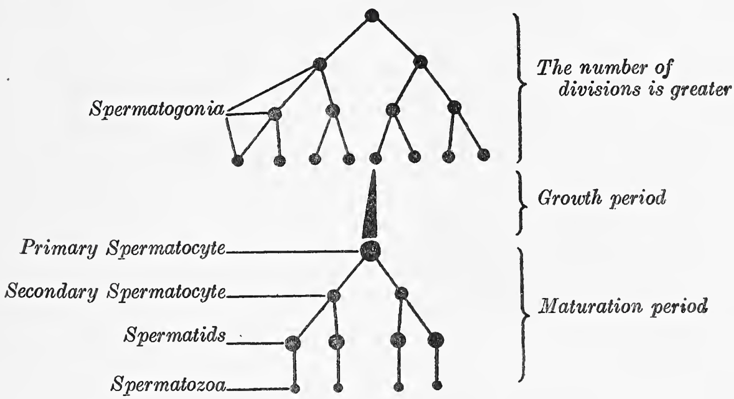


FORMATION OF POLAR BODIES IN ASCARIS MEGALOCEPHALA VAR. BIVALENS. (Boveri.)

A. The egg, with sperm entering at X; the germinal vesicle contains two tetrads, the number of chromosomes in the species being four. B. First polar spindle. C. The tetrads dividing. D. First polar body formed, containing like the egg, two dyads. E, F. The dyads rotating into position for the second division, *p.b.* first polar body. G. The dyads dividing. H. Each dyad has divided into two single chromosomes, thus completing the reduction, the two at the periphery forming the second polar body $p.b_2$.

of chromosomes being four. During the formation of the first polar body, each tetrad becomes halved, to form two double groups or dyads; one group of dyads remains in the egg, the other joins the polar body. It is therefore evident that both the polar body and the egg receive a number of

dyads equal to one half the usual number of chromosomes. The egg at once forms the second polar body, without any intervening reconstruction of the nucleus. Each dyad splits to form two single chromosomes, two single ones remaining in the egg, the other two going to the second polar body. According to this arrangement, both egg and second polar body each receive two single chromosomes, which is one half of the original number. The two remaining in the egg now form a nucleus.



THE GENESIS OF THE SPERMATOZOON. (Boveri.)

REDUCTION IN THE MALE.

Reduction in the male is a similar process to that maintaining in the female. In the same way as the ova the spermatozoa are descended from the primordial germ cells, which, undergoing mitosis, produce the spermatogonia. In the same manner as the oogonia, the spermatogonia continue to divide for a time, possessing the full number of chromosomes, *i.e.* four in *Ascaris*. The process of division is arrested for a time, and the spermatogonia enlarge to form spermatocytes. Each spermatocyte divides twice in rapid succession, the first division producing two daughter spermatocytes, the second division four spermatids, each of which becomes a spermatozoon. The chromatin reduction occurs in an exactly similar manner as in the case of the ovum, each spermatozoon receiving one half the usual number of single chromosomes.

Weismann's Theory of Reduction.

The object of the process of reduction of the chromosomes in the germ-cells is to maintain the constant number characteristic of the species, for without such a reduction the number

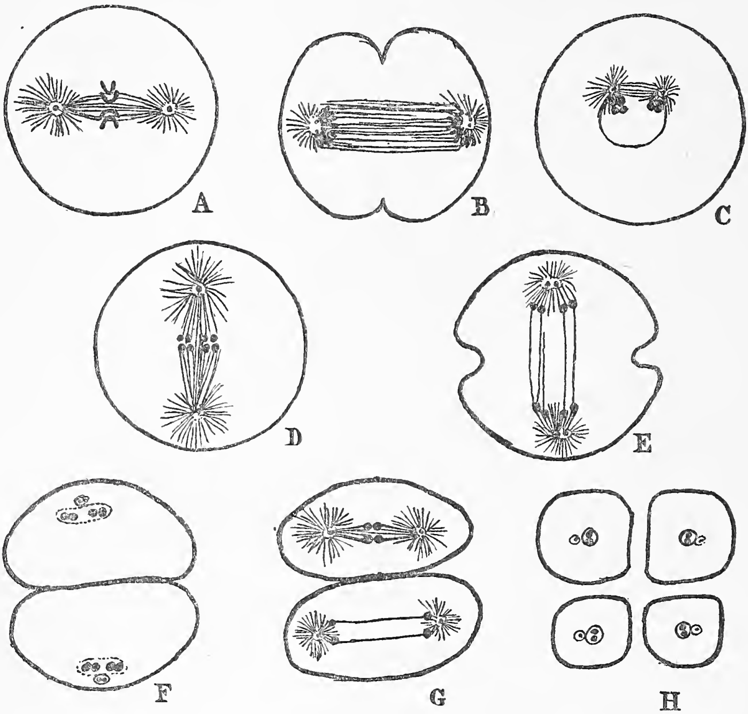


Diagram showing Reduction in the Male. Somatic Number of Chromosomes is supposed to be Four.

A, B. Division of one of the spermatogonia showing the full number (four) of chromosomes. C. Primary spermatocyte preparing for division; the chromatin forms two tetrads. D, E, F. First division to form two secondary spermatocytes, each of which receives two dyads. G, H. Division of the two secondary spermatocytes to form four spermatids. Each spermatid receives two single chromosomes and a centrosome which passes into the middle-piece of the spermatozoon.

would be doubled in each succeeding generation. Why should the number of chromosomes for a species be constant? Weismann's theory is based on a paper written by W. Roux in

1883. Roux argued that in order to understand and account for the complex process of mitosis it must be assumed that the chromatin differs in different regions, representing certain qualities in some, and others in other portions. He insisted that, if the chromatin was the same throughout, the process of direct division would be quite as effective as the very complicated process of karyokinesis, and this intricate method, by which there is an exact longitudinal splitting of the thread, would be a mere waste of energy.

Weismann's explanation of the process of fertilisation is that it brings about new mixtures of different 'ids.' The term 'id' used by him represents the visible chromatin granules, which are arranged in a linear series to form 'idants' or chromosomes.

The number of 'ids,' however, would be doubled by the union of two germ-nuclei; and should there not be a reduction of the chromatin prior to this union, in a few generations it would become exceedingly complicated. From his assumption that the ancestral germ-plasms (ids) are arranged in a linear series in the spireme thread, or the chromosomes derived from it, he prophesied that two kinds of mitosis would occur: the first a longitudinal division of the thread, which would bring about an equal distribution of the ancestral plasms to the daughter nuclei; the second form of division which he postulated was of such a character that each daughter-nucleus would receive half the number possessed by the mother-nucleus. He also assumed that this was brought about either by a transverse division of the chromosomes or by getting rid of complete chromosomes without division. Weismann, pursuing the subject still further, maintained that the reduction must be involved in the formation of the polar bodies, and in the similar phenomena occurring during spermatogenesis. Weismann's prophecy has been verified by the most rigid microscopical scrutiny. As Boveri has said: 'Thus, at some stage or other in the generation series of the germ-cells, there occurs a reduction of the number of chromosomes originally present to one half, and this numerical reduction is therefore to be regarded, not as a mere theoretical postulate, but as a fact.'

Fertilisation.

The egg of the sea-urchin is admirably adapted for watching the process of fusion between it and the sperm. The phenomenon occurring in sea-water, the germinal cells being cast out from the parents, one is able to collect eggs and spermatozoa separately, bringing them together in suitable vessels containing

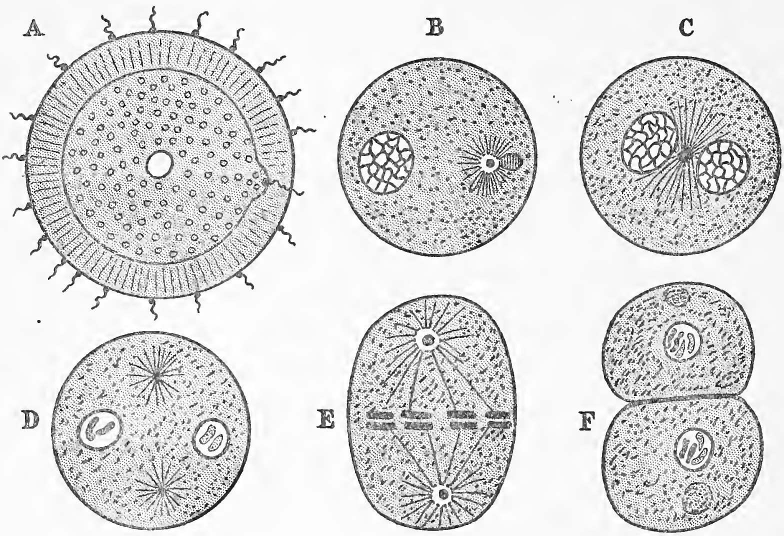


Diagram of the Fertilisation of the Egg. (After Boveri.)

A. Egg surrounded by spermatozoa ; on the right one has penetrated the egg membrane, and is entering the cytoplasm. The egg nucleus is seen in the centre. B. Egg-nucleus, with chromatin reticulum on the left ; on the right is seen the sperm-nucleus (head of spermatozoon) preceded by its centrosome and attraction sphere. C. Egg-nucleus on the left, sperm-nucleus on the right of the centre of egg. D. The centrosome has divided, the two attraction spheres separate to form the first cleavage-spindle. E. The first cleavage-spindles with splitting of the chromosomes. F. Completion of first cleavage, each nucleus contains four chromosomes, two from the egg, and two from the sperm.

N.B.—In the diagram the sperm-chromosomes are shaded ; those from the egg-nucleus are black.

sea-water. The process can be watched under the microscope, and eggs killed at the various stages can be sectioned and mounted for future detailed examination. In the explanatory diagrams, which are after Boveri, A is the egg, surrounded by its envelope, and containing a clear nucleus. Around

the periphery can be seen spermatozoa trying to get into the egg substance ; at the right-hand side one has been more successful than the rest, having pierced the peripheral envelope, and is passing into the egg-cytoplasm. As soon as the head of one spermatozoon has entered, a new membrane forms around the egg substance which prevents the entrance of any more. There is evidence of a definite attraction between the germ-cells. The nature of the attraction appears to be chemical, since the spermatozoids of ferns are actively attracted by solutions of malic acid; those of mosses are not affected by malic acid, but by cane-sugar. This attractive force is not inherent in the nucleus alone, but is also present in the cytoplasm. The head and middle piece pass into the egg substance, the tail remaining in the egg membrane, where it degenerates. Very shortly after the entrance of the sperm, a series of radiations make their appearance around the middle piece, forming an aster surrounding a centrosome, B. The head of the spermatozoon or sperm nucleus swells, increasing to a considerable size, its chromatin becoming arranged to form a reticulum, C. At the same time the chromatin reticulum of the egg nucleus becomes more definite. Sperm aster and sperm nucleus now move toward the egg nucleus, the aster generally leading the way. On nearer approach the sperm nucleus increases still more in size, until it becomes indistinguishable from the egg nucleus C. The chromatin network of each nucleus now forms a number of chromosomes (one half the number in each nucleus as are found in the somatic cells). The nuclei come together and fuse.

In the sea-urchin *Echinus* the number of chromosomes is eighteen, nine being found in each germ nucleus. In the diagram, for the sake of simplicity, only two are shown, those of the sperm being shaded, while those of the egg nucleus are black.

The centrosome divides with its aster (D), the daughter centrosomes moving apart to the opposite poles of the egg, thus forming the usual amphiaster of cell-division (E) ; the chromosomes become arranged in the equatorial plane of the spindle, and each one divides longitudinally. The halves are now drawn apart by the astral rays towards the opposite

poles, the egg dividing transversely into two cells (F). This phenomenon of division is repeated continuously, and from the resulting mass of cells is developed the new organism.

The centrosome, which must be regarded as the dynamic centre, the presence of which initiated these various changes, is derived solely from the spermatozoon, the egg on the other hand supplying the yolk and the bulk of the cytoplasm.

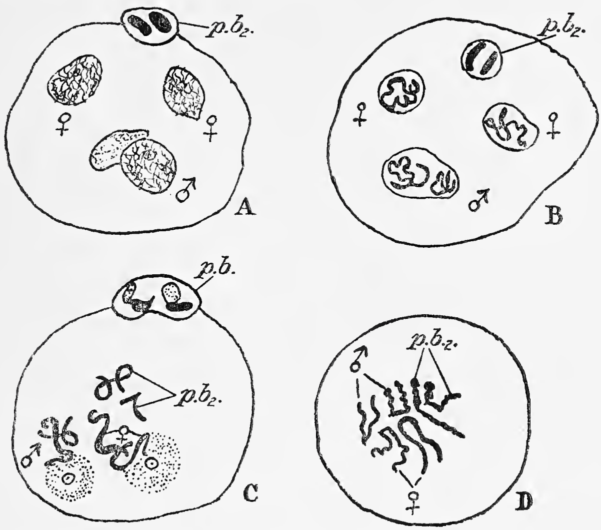
Individuality of the Chromosomes.

It is an established fact that a nucleus is never formed *de novo,* but must arise by the division of a pre-existing nucleus. In mitosis the chromatin is resolved into bodies called chromosomes, which have the power of growth and division, the same as the nucleus, forming in fact morphological individuals of a lower grade than the nucleus. This individual independence of the isolated chromosome has been strongly maintained by Rabl and Boveri. Rabl concluded that 'the chromosomes do not lose their individuality at the close of division, but persist in the chromatin reticulum of the resting nucleus. The so-called loss of identity during the resting stage is only apparent. At the commencement of the next division they again appear, the chromatic substance flowing back, through predetermined paths, into the primary chromosome-bodies.'

From many observations made, it would appear that, whatever be the number of chromosomes entering into the formation of a reticular nucleus, the same number always issues from it—this result proving that the number of chromosomes is due to the morphological organisation of the nucleus. Boveri confirmed this in echinoderms, by removing the nuclei from egg-fragments and fertilising these enucleated portions with single spermatozoa, the result being that the nuclei of such larvæ contain only half the normal number of chromosomes.

As further evidence, Van Beneden and Boveri showed clearly in *Ascaris* that during the development of the spireme the chromosomes actually appear in the same position as those which formed the reticulum. During the divergence of the chromosomes, the free ends are directed towards the mesial plane, and on the reconstruction of the daughter-nuclei these

ends form corresponding lobes of the nucleus. During the following division the chromosomes make their appearance in the same position, their ' ends lying in the nuclear lobes as before.' From this and similar evidence, the chromosomes must be looked upon as elementary organisms, leading an independent existence in the cell.



EVIDENCE OF THE INDIVIDUALITY OF THE CHROMOSOMES.
ABNORMALITIES IN THE FERTILISATION OF ASCARIS. (Boveri.)

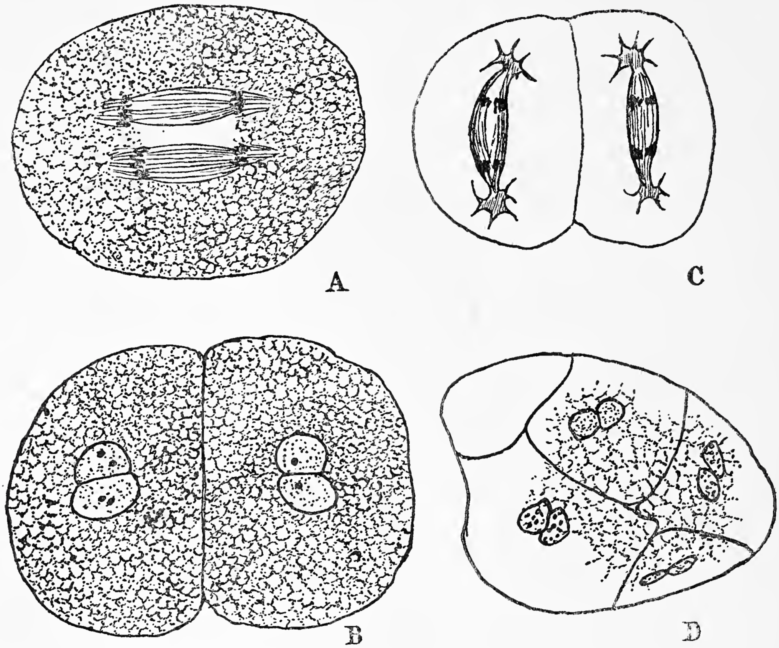
A. The two chromosomes of the egg-nucleus, accidentally separated, have given rise each to a reticular nucleus (♀ , ♀) ; the sperm nucleus below (♂). B. Later stage of the same, a single chromosome in egg nucleus, two in the sperm nucleus. C. An egg in which the second polar body has been retained ; $p.b_2$. the two chromosomes arising from it ; ♀ the egg chromosomes ; ♂ the sperm chromosomes. D. Resulting equatorial plate with six chromosomes.

Boveri, applying this reasoning to the fertilisation of the egg, came to the conclusion that ' we may identify every chromatic element arising from a resting nucleus with a definite element that entered into the formation of that nucleus, from which the remarkable conclusion follows that in all cells derived in the regular course of division from the fertilised egg one half of the chromosomes is of strictly paternal origin, the other half of maternal.'

Boveri's hypothesis was severely criticised at the time,

but later observations made by Rückert and others have clearly proved the truth of his theory.

Rückert and Hacker have shown, that in *Cyclops*, the paternal and maternal chromosomes remain separated during the anaphase, and also give rise to double nuclei in the two-cell stage. Herla and Zoja show that if the variety of



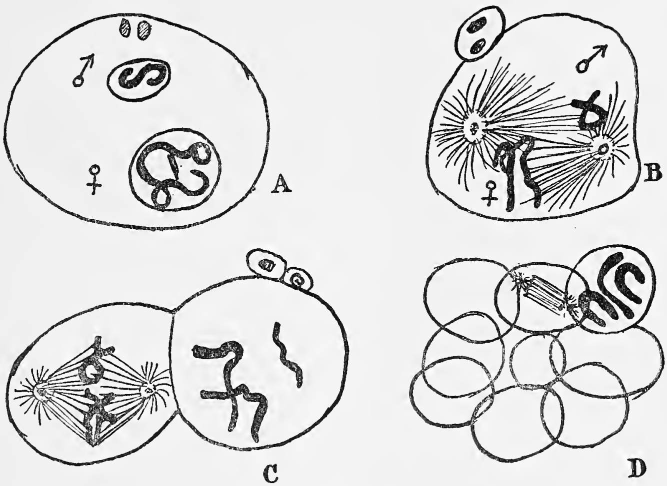
INDEPENDENCE OF PATERNAL AND MATERNAL CHROMATIN IN THE SEGMENTING EGGS OF CYCLOPS.

A. First cleavage figure. complete independence of paternal and maternal chromosomes. B. Resulting two-cell stage with double nuclei. C. Second cleavage; chromosomes still in double groups. D. Blastomeres with double nuclei from the eight-cell stage. (A–C. from Rückert, D from Hacker.)

Ascaris having two chromosomes (*bivalens*) be fertilised with a spermatozoon of the variety *univalens* having one chromosome, the three chromosomes appear at each successive cleavage, and the paternal chromosome, from its smaller size, can be distinguished from the two maternal ones at each division.

Physiological Relations of Nucleus and Cytoplasm.

Claude Bernard maintained that chemical synthesis, the process by which organic compounds are built up, and morphological synthesis, by which these compounds are arranged into an organised body, are different phases of the same phenomenon, and that both are the result of nuclear activity. A few



Hybrid Fertilisation of the Egg of Ascaris megalocephala, var. bivalens by the Spermatozoon of var. univalens.

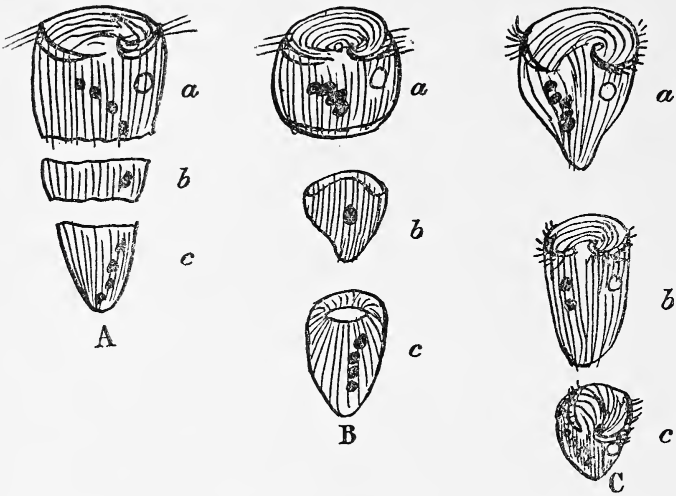
A. The germ-nuclei shortly before union. B. The cleavage figure forming, the sperm nucleus has given rise to one chromosome (♂) the egg nucleus to two (♀). C. Two-cell stage dividing showing the three chromosomes in each cell. D. Twelve-cell stage, with the three distinct chromosomes still shown in the primordial germ-cell. (Herla.)

experiments will suffice to prove that morphological and chemical synthesis are the result of nuclear action, and therefore that the nucleus must be looked upon as the essential organ of inheritance.

Besides experiments on unicellular forms, evidence to the effect that the nucleus is the organ of inheritance will be brought from such phenomena as mitosis, maturation, and fertilisation.

Experiments on Unicellular Forms.—Evidence as regards the behaviour of enucleated and nucleated fragments.

Nussbaum took the infusorian *Oxytricha* and cut it into two portions, one portion containing the nucleus, the other fragment being without any trace of nuclear material. The wound in the nucleated portion quickly healed, the missing portion became regenerated, and a perfect form resulted. The enucleated portion, which consisted only of cytoplasm, showed no signs of vital reaction, and rapidly died. Nussbaum con-



REGENERATION IN STENTOR.

A. Divided into three parts, each containing portion of the nucleus. B. The three portions shortly afterwards. C. After twenty-four hours, each forming a perfect animal. (After Gruber.)

cluded from the above that the faculty of constructive metabolism, or it may be termed the power of regeneration, was inherent in the nucleus.

Gruber repeated these experiments on another infusorian, *Stentor*. A fragment which contained a large portion of the nucleus underwent complete recovery and regeneration in twenty-four hours. A fragment possessing only a small particle of the nuclear material substance recovered very slowly. Any portion in which there was no nuclear material present showed no signs of regeneration, though it might continue to live for some time. It has been further demon-

trated that if *Stentor* be violently shaken it breaks up into fragments of every possible size, and that a portion as small as 1–27th of the original animal, provided it contained the nucleus underwent complete regeneration. All the portions without nuclear material die.

Verworn has shown that in the foraminifer *Polystomella* nucleated portions possess the power of repairing the shell; portions without nuclear material cannot do this. It has been shown that non-nucleated fragments of *Amœba* may live as long as fourteen days. The movements gradually cease, the function of digestion is arrested, and it is incapable of secreting the slime by which it adheres to the substratum.

Verworn has further shown that both in infusoria and rhizopods non-nucleated portions live for a considerable length of time, perform normal movements, respond to various stimuli, and are also able to take up food material. They have lost, however, the power of digestion and secretion, and therefore must of a necessity die prematurely. In connection with this exceedingly interesting subject students of physiology will at once recall to mind the Wallerian law of degeneration. Waller's law may be included in the statement that 'a nerve degenerates when removed from its trophic centre.' The motor nerves, whose function it is to carry impulses to the muscles of the body, arise from large branched cells situated in the grey surface matter of two adjacent and parallel convolutions of the brain, and passing along a well-defined course enter the spinal cord, down which they travel, leaving it at different levels according to their final destination. It is important to note, however, that before emerging from the cord (it matters not at what level) they communicate with another set of branched nerve-cells situated in the anterior or frontal aspect of the cord, and known as the anterior vesicular column. Having established this communication they proceed to their final termination, viz. the voluntary muscles of the body and limbs.

Should a number of the cells on the cortex cerebri, from which these nerves arise, be damaged, those nerve fibres coming from the affected cells will degenerate downwards as far as

the anterior vesicular column. These same nerve-fibres will not degenerate any further, but will retain their physiological integrity. Should, however, the cells of the anterior vesicular column with which these fibres are in connection be damaged, then the motor nerves will degenerate right to their peripheral endings in the muscles.

It is therefore evident that the branched cells of the brain surface referred to exert a powerful influence on the nerve fibres emanating from them, this influence being of such a nature that damage to these cells will be followed not only by loss of function in the nerve tracks, but also degeneration of the constituent fibres. The same statement applies to the branched cells of the anterior vesicular column, which, if damaged, will be followed by loss of function and descending degeneration to the periphery.

From these facts it will at once be concluded that the motor nerves are under the control of two great trophic centres, one located on the surface of the brain (Rolandic area), the other in the spinal cord.

To the first Professor Wyllie has given the name of First Trophic Realm, while the other has been named by the same eminent authority the Second Trophic Realm. The sensory nerves have their own special trophic realm quite distinct from the motor ones. The large multipolar ganglion cells constituting these trophic centres are furnished with well-defined nuclei; and it is in these nuclei that the powers of nourishment, regeneration, and maintenance of the stability of the nerve reside. Every experiment goes to prove that destructive metabolism may go on in the cytoplasm of a cell which has been robbed of its nucleus. The result of this metabolic process is contractility, &c., of the protoplasmic mass. These phenomena, however, after a period of variable length cease, and death ensues. The reason why premature death always supervenes is that the faculty of chemical and morphological synthesis is not present in the cytoplasm, but is a special inherent property of the nuclear material. It is the nucleus which initiates these important phenomena in the cytoplasm, by which it is enabled to digest and store up food material to form a reserve of potential energy for future

use. The cytoplasm, being devoid of this synthetical faculty and being merely endowed with the property of destructive metabolism, uses up its stored energy and soon dies. It is therefore of the utmost importance to remember that the nucleus initiates the phenomena of both chemical and morphological synthesis, a fact of essential value in support of the theory of inheritance.

The study of the cells of plants has added weight to the above evidence. It has been shown that detached fragments of certain algæ which were devoid of nuclear material were incapable of developing an envelope of cellulose. The cells of certain forms can be broken up into portions, some of which are nucleated, others non-nucleated : the nucleated fragments clothe themselves in a new garment of cellulose, and by the process of morphological synthesis regenerate into complete plants, down to the minutest detail. The non-nucleated portions, while able to form starch on account of their contained chlorophyll, are unable to use it, neither can they develop a new covering of cellulose, neither can they grow, nor regenerate lost portions.

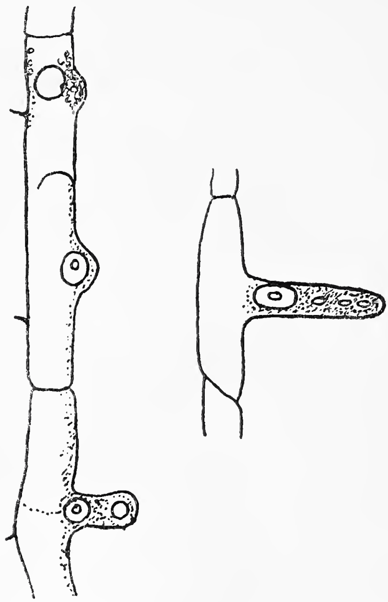
Position and Movements of the Nucleus

Observers have clearly demonstrated that local growth of a cell-wall is always associated with a previous migration of the nucleus to the point where the growth is taking place. In connection with the cells of the epidermis the nucleus is at first placed centrally ; when growth of the wall occurs the nucleus moves towards, and remains continuous with, the growing surface. That this is not a movement in search of light and air is proved by the fact that in many cells the nucleus moves to the inner and not the outer wall, and there causes thickening and growth.

That the process of growth is initiated by the nucleus is beautifully illustrated in the case of the root-hairs in the pea, in which the first rudiment of an outgrowth always occurs in the vicinity of the nucleus, the nucleus passing outwards in the direction of the growing hair. An exception to this would at first appear in the case of the hairs of aerial

plants, in which the nucleus lies near the base of the hair; the discrepancy, however, is only apparent, as it has been definitely shown that in these cases the growth is basal and not apical.

From the above it will at once be conceded that the nucleus initiates morphological synthesis, the result of its presence being the orderly and natural development of the structure.

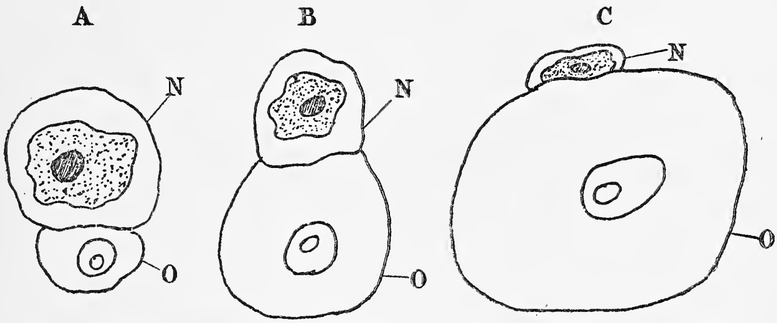


Position of Nuclei in Growing Root Hairs of the Pea.
(Haberlandt.)

According to Korschelt 'there is a definite correlation, on the one hand, between the position of the nucleus and the source of food-supply, on the other hand between the size of the nucleus and the extent of its surface and the elaboration of material by the cell.' In proof of the latter, we have the enormous nuclei of secreting cells, these nuclei being very branched, so that there is a maximum of their surface brought into action. This kind of nucleus, with its associated function, is well exemplified in the case of the Annelids, in some forms

of which the egg is closely attended by a nurse-cell which is attached to its side. In the case of the Annelid *Ophryotrocha* the nurse-cell is at first considerably larger than the egg itself, possessing a large nucleus loaded with chromatin. While the egg-cell grows at a great rate, there is a corresponding rapid diminution in the size of the nurse-cell, which, becoming a mere rudiment, finally disappears. From this it is evident there is a very close association between the nurse-cell and the growing egg.

The observations of Wheeler on another form are of special interest. In this case the egg-cell is accompanied by two



Egg and Nurse-cell in the Annelid, Ophryotrocha. (Korschelt.)

A. Young stage, the nurse-cell at (N) is larger than the egg (O). B. The ovum growing. C. Degeneration of the nurse-cell (N).

nurse-cells, one placed at either end. Quoting from Wheeler, ‘these cells fuse bodily with the egg, one having something to do in forming the vacuolated cytoplasm at the animal pole, the other in forming the granular cytoplasm at the vegetable pole.’ (‘The Maturation, Fecundation, and early Cleavage in *Myzostoma*.’) This determination of the polar axis maintains in the ripe ovum.

In the earwig *Forficula* the egg-cells are accompanied by large nutritive nurse-cells, these cells possessing well-defined nuclei richly endowed with chromatin.

From the above examples one is naturally drawn to the conclusion that the nurse-cell greatly assists in, if it is not wholly responsible for, the elaboration of the cytoplasm of

the egg, and also that the very marked development of the nucleus in these cells is correlated with this function.

With regard to the position of the nucleus and the source of food supply, one most interesting case only will be mentioned, viz. that of the water-beetle *Dytiscus* in which Korschelt was able to watch the phenomena in the living form. The eggs lie alternating with nutritive cells. These nurse-cells contain granules which are believed to pass into the egg. That such is the case is all but evident from the fact that the egg contains quantities of similar granules, which are seen lying in masses extending from the nurse-cells right to the germinal vesicle, which they often envelop. The germinal vesicle (egg-nucleus) now assumes the function of amœboid movement, and extends its false limbs always towards the mass of granules.

The exceedingly rapid growth of the germinal vesicle at this period points to the conclusion that the granules are absorbed into its substance.

All the observations made go to show that the nucleus of the cell plays an important part in the process of nutrition, and that it obtains a maximum activity during the phases which are characterised by greatly increased growth. It is therefore evident that, so far, the behaviour of the nucleus corroborates and is in harmony with the results obtained from experiments on one-celled forms.

The Nucleus in Mitosis.

W. Roux was the first to point out that 'the essential operation of nuclear division is the division of the mother-granules' (chromatin grains); 'all the other phenomena are for the purpose of transporting the daughter-granules derived from the division of a mother-granule, one to the centre of one of the daughter-cells, the other to the centre of the other.' The cytoplasm, on the other hand, merely undergoes a mass division.

The great central fact must be insisted on that the chromatin of the mother-cell is 'distributed with the most scrupulous equality to the nuclei of the daughter-cells,' and that in this regard there is a most remarkable contrast between nucleus

and cytoplasm. This fundamental process of cell-division is characteristic of all living forms, and from this fact alone it is evidently a phenomenon of the most profound importance.

This radical difference between cytoplasmic and nuclear division, by which in the case of the nucleus the chromatin is passed on from the mother-cell to its progeny, leads one irresistibly to the only logical conclusion—that chromatin is the physical basis of heredity.

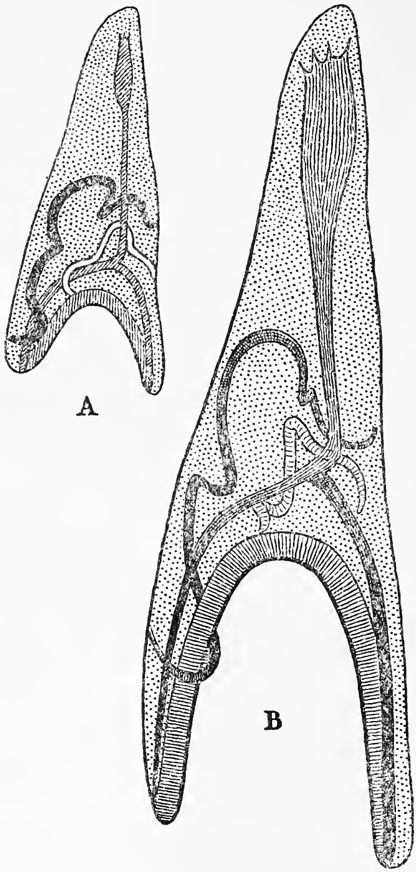
The Nucleus in Fertilisation.

The facts derived from the process of fertilisation lend a weight to the argument in favour of the nucleus which is overwhelming. As is well known, the ovum supplies practically all the cytoplasm for the embryonic body, the amount derived from the spermatozoon being infinitesimal, and yet the influence of the sperm on the offspring is quite as great as that of the ovum.

The chromatin of the germ-nuclei is divided with absolute equality between the first two, and very probably to all the later-developed cells. That this equal division of the chromatin among all later-formed cells is practically a certainty must be conceded from the experiments of Rückert and others described elsewhere. It is therefore evident that the character of the cell is the result of nuclear action, and that on account of the equal distribution of the maternal and paternal chromatin to every cell descended from the original germ-nuclei we get an insight into the remarkable fact that every part of the offspring may be like either or both parents.

Boveri performed a series of brilliant experiments with the eggs of two different species of sea-urchins, *Echinus microtuberculatus* and *Sphœrechinus granularis,* which are very common in the Bay of Naples. If the minute eggs of either of these species are violently shaken with a little sea-water in a suitable vessel, they break up into various-sized fragments, some of which contain nuclei, others not. Boveri found that these fragments, if fertilised, developed into normal larvæ. The non-nucleated as well as the nucleated portions developed in the usual manner, the spermatozoa entering both with

equal agility. The larval forms of *Echinus* and *Sphœrechinus* are very different in shape, and after a couple of days' development can be recognised with great ease.



A. Dwarf arising from an Enucleated egg fragment of *Sphœrechinus granularis*, fertilised with spermatozoon of *Echinus microtuberculatus*, and showing purely paternal characters. B. Normal *Echinus microtuberculatus*, Boveri. It will be seen they are practically identical except as regards size.

Having made quite sure of these facts, Boveri cross-fertilised the eggs of *Sphœrechinus* with the sperm of *Echinus*. The

resulting larvæ were of a form midway between that of the parents, showing certain characteristics of each. This hybrid formed a new type which was constant, and was never known to simulate either *Echinus* or *Sphœrechinus* to such a degree as to be mistaken for them.

Four important factors are thus established :—

1. The constancy of *Echinus* larval type.
2. The constancy of *Sphœrechinus* larval type.
3. The constancy of the hybrid between *Echinus* ♂ and *Sphœrechinus* ♀.
4. The ability to secure non-nucleated *Sphœrechinus* fragments which were capable of fertilisation.

The final test would be to cross-fertilise non-nucleated portions of *Sphœrechinus* with *Echinus* sperm. The kind of larvæ resulting from this cross would decide the question. If the resulting larvæ are of a hybrid type, then both nucleus and cytoplasm determine the hereditary characters. If pure *Sphœrechinus* results, then the cytoplasm is the bearer of the hereditary qualities. Should, however, the result be of the pure *Echinus* type, then to the nucleus of the spermatozoon alone can be credited the power of determining the quality of the offspring. The larvæ obtained by Boveri were of pure paternal or *Echinus* type, there being no taint whatever of the maternal element. The development of these larvæ has been brought about solely by the nucleus of the spermatozoon. Thus by pure experimental evidence the chromatin material has been shown to be the physical basis of heredity, the cytoplasm which is represented by *Sphœrechinus* having had no influence in determining the type of larva which results.

The Nucleus during the Process of Maturation.

The phenomena occurring during maturation bring out in quite as convincing a manner the great difference between cytoplasm and nucleus. The germ-nuclei undergo the exceedingly complicated series of changes associated with chromatin reduction, thus rendering them absolutely equivalent at the time of their union. When this fact is taken in conjunction with the result of the union of the germ-cells, which

produce an embryonic form in which, on the whole, both the characters of the germ-cells have an equal effect, it is to be concluded that the chromatin of the nucleus is the source of hereditary characters, while the position of the cytoplasm is merely that of a subordinate agent.

Weismann's Theory of Germinal Continuity. *Homo nascitur, non fit.*

The older theories of heredity assumed that the germ-cells were made up of samples taken from every part of the body. This is the conception embodied in Darwin's theory of Pangenesis. These ultra-microscopical particles derived from all the cells of the individual were termed gemmules, and were supposed to circulate in the body, finally coming to rest in the germ-cells. By this theory Darwin sought to explain such phenomena as the regeneration of lost parts, the inheritance of acquired characters (the Lamarckian factors), sexual and non-sexual reproduction, also reversion to a distant ancestor.

The hypothesis (which Darwin himself described as only provisional) was one of the first in which an attempt was made to account for the above phenomena. It, however, never received much support, there being no evidence of the existence of gemmules, and the idea of so many millions of these particles finding a resting-place in the germ-cells was incomprehensible. Darwin's theory, however, did one great service to the science of biology—it stimulated thought, and led to the development of other theories which finally culminated in Weismann's celebrated doctrine of Germinal Continuity.

The central conception of Weismann's theory is that the germ-cells possess an independence of their own, that they are quite distinct from the body or somatic cells; also that the germ-cells of one generation give rise, not only to the bodies of the next generation, but also to their contained germ-cells; in other words, the body cannot produce germ-cells, but merely contains them.

Weismann challenged the whole of the Lamarckian principle in the following words: 'I do not propose to treat of the whole

problem of heredity, but only of a certain aspect of it—the transmission of acquired characters, which has been hitherto assumed to occur. In taking this course I may say that it was impossible to avoid going back to the foundation of all phenomena of heredity, and to determine the substance with which they must be connected. In my opinion this can only be the substance of the germ-cells, and this substance transfers its hereditary tendencies from generation to generation, at first unchanged, and always uninfluenced in any corresponding manner by that which happens during the life of the individual which bears it.

'If these views be correct, all our ideas upon the transformation of species require thorough modification, for the whole principle of evolution by means of exercise (use and disuse) as professed by Lamarck, and accepted in some cases by Darwin, entirely collapses.' (See 'Essays on Heredity,' vol. i., by A. Weismann, Clarendon Press, Oxford, 1889.)

Continuing in the same line of thought, he maintains the absolute impossibility of acquired characters being transmitted, and also how inconceivable it is that changes in the body or 'soma' should affect the protoplasm of the germ-cells in such a manner as to produce similar changes in the offspring. He asks—How is it possible that the dexterity in the hand of a piano-player can so affect the structure of the germ-cells as to produce an equivalent dexterity in the hand of the child?

Weismann, in fact, maintains that none of the so-called cases of transmission of acquired characters will stand a scientific test.

The child inherits from the parent germ-cell, not from the parent body, and the germ-cell owes its characteristics not to the body which bears it, but to its descent from a pre-existing germ-cell of the same kind. From the point of inheritance, the body merely carries the germ-cells, which are as it were held in trust for the development of future generations. According to Sir Michael Foster, the animal body is in reality a vehicle for ova; and after the life of the parent has become potentially renewed in the offspring, the body remains as a cast-off envelope whose future is but to die.

The question asked by the older biologists was—How do the characters of the organism get into the germ-cells which it produces? The real question is—How are the characters of an organism represented in the germ-cell which produces it? To understand the relation existing between successive generations, we should say in the words of Samuel Butler, not that a hen produces another hen through the medium of an egg, but that a hen is merely an egg's way of producing another egg.

To put the problem in its simplest form, the question is, not how the characters get into the germ-cells, but how the characters are represented in the germ-cells.

Weismann[1] draws a very sharp line between the body substance, or body plasm, and the germ plasm. To quote an example: An egg contains germ plasm, which was derived from that of the parent; the egg develops and so does the germ plasm, and gradually the germ plasm becomes converted into body plasm, which forms the resulting chick. Some of the germ plasm, however, is not used up to form body substance, but remains as such, forming the germ-cells of the next generation. As a Weismannian axiom allow me to state that, while germ plasm may be and is converted into body plasm, body plasm can never become germ plasm.

In this one statement lies the explanation of what is gradually becoming an accepted fact, viz. that any change affecting the body-cells but not the germ-cells cannot be transmitted to future generations. Thus acquired characters (Lamarckian factors) in the true sense cannot be inherited. The germ plasm of one generation is passed on to the next, and so on and on, and influences coming from without cannot affect the germ-cells, and therefore cannot be transmitted. The germ-cells must be looked upon as the links in a long, unbroken chain of germ plasm, which under certain conditions, usually the union of two germ-cells, produce a body, the germ-cells still continuing their existence in this body. Thus we get the conception of a long line of germ plasm, budding out from which at regular intervals is a new generation, the individual or individuals of

[1] *Mendelism in Theory and Practice*, E. Wynstone-Waters.

which still carry in their bodies a supply of the germ plasm. The generations or buds attached along this continuous chain are mortal; the germ plasm itself, however, only ends when the individual containing it dies without issue. We must therefore look upon the body as a new formation which soon ceases to live, but which passes on to its offspring a portion of the original germ plasm; the germ plasm itself having existed far back through the ages that have been to the very commencement of all life.

As we have already seen, during the maturation of the germ-cells half of the chromosomes or germ plasms will be removed, and the next generation will receive a fresh mixture. It is therefore evident that the chromosomes of any single individual contain germ plasms descended from various ancestors. In fact, the chromosomes must be looked upon as containing a mosaic of ancestral germ plasms. Different individuals will contain different mixtures, and this explains Weismann's hypothesis of the origin of variations. Varying combinations of ancestral plasms will bring about differences in individuals, new combinations will occur in every fertilised ovum, and as a result there must be variations between individuals.

Any influence which acted directly as a stimulus on the germ plasm may so modify it that the effects of this stimulation may be transmitted. The chromosome is a battlefield in which the units of the germ plasm are carrying on a desperate struggle among themselves for nourishment; some will acquire more nourishment than others, and should this line of increase be carried on in the chromosomes of successive generations, certain characters (corresponding to the glutted units) would become accentuated, while others (corresponding to the attenuated ones) would diminish. These variations, arising as they do in the germ plasm, will of necessity be inherited, and will differ in the most radical manner from any changes brought about in the body during life as a result of environment; these latter changes coming from without cannot reach or affect the germ-cells, and therefore cannot be transmitted.

'The distinction between these characters of an organism which it acquires by use or disuse during its life, or which are impressed upon it by its environment, and those characters,

which it receives as a birthright from its parents or have originated in the germ from which it has sprung, was not clearly perceived until Weismann's teaching had taken root, but his central position is now the basis of all modern work on heredity and has introduced a different temper into the believers of progress. Whilst it was still possible to hold that characters or attainments acquired during the lifetime and activity of the organism were commonly transmitted to its descendants, a rapid and constant evolution in an upward direction seemed possible for the human race. Man had only to strive, his descendants would proportionally increase in virtue, and a race of men would be evolved which might know or even practise the proscriptions of the Mosaic dispensation from their earliest infancy. The realities of history and heredity do not sanction such dreams, and we must be content to know that while man may lose almost everything by the loss of a tradition, he can never by vicarious effort spare his descendants the pain of assiduously acquiring it by practice.' [1]

I will conclude with a quotation from Prof. Punnett's classical Essay on Mendelism. 'Education is to a man what manure is to a pea. The educated are in themselves the better for it, but their experience will alter not one jot the irrevocable nature of their offspring. Permanent progress is a question of breeding rather than of pedagogics ; a matter of gametes, not of training. As our knowledge of heredity clears, and the mists of superstition are dispelled, there grows upon us with ever-increasing and relentless force the conviction that the creature is not made but born.' [2]

[1] *Primitive Animals.* By Geoffrey Smith.
[2] *Mendelism.* By R. C. Punnett.

ON THE SPINY MICE OF BRITISH EAST AFRICA, WITH A DESCRIPTION OF A NEW SPECIES FROM MAGADI

By Guy Dollman

From 'The Annals and Magazine of Natural History'

In the collection of mammals recently presented to the British Museum by A. Blayney Percival, Esq., is a series of Spiny Mice from Magadi, South Masailand District, British East Africa; these specimens represent an entirely new species, which is here described as

Acomys nubilus, sp. n.

About equal to *Acomys Wilsoni* in size, but with longer tail and very much darker in general colour.

Size of body less than in the *ignitus* and *pulchellus* groups, more as in the short-tailed *Wilsoni*; tail fairly long, measuring from 65 to 67 mm. in length, and thus much longer than in the other small species, where the tail very rarely exceeds 50 mm. in length.

General colour of dorsal surface dark sepia-brown, slightly speckled with buff, but not exhibiting the marked speckled effect found in *Wilsoni* and *ablutus*. Flanks pale buff, speckled with dark brown. Backs of hands and feet dirty white. Entire underparts white.

Skull very much like that of *Wilsoni*, slightly larger throughout, with a rather broader brain-case.

Dimensions of the type (measured in the flesh): Head and body 83 mm.; tail 65; hind foot 14; ear 12.

Skull of type badly broken; the following dimensions are those of another specimen, No. 1477, from the type-locality: greatest length 25·4; condylo-incisive length 22·4; zygomatic breadth 12; interorbital constriction 4·5; breadth of brain-case 12; length of palatal foramina 5·8; length of upper molar series 4.

This specimen (No. 1477) is exactly similar to the type in general colour, but I have not been able to use it as a type, since the tail is badly broken.

Type.—Adult. Original number 1481. Collected June 14, 1913.

This striking and distinct species is immediately distinguished from *A. Wilsoni* by its very much longer tail and darker colour; in general colour *nubilus* is darker than any of the other East African *Acomys*, with the exception of the slate-coloured *Percivali*. It is a little difficult to decide to which group this species belongs, and for the present it seems most satisfactory to regard it as a link between the large long-tailed *ignitus* group and the short-tailed *Wilsoni*.

The following are the various forms of *Acomys* now recognised in British East Africa:—

1. *Acomys ignitus*, Dollm., originally described from specimens collected by Mr. Kemp at Voi, has since been found by Mr. Percival at various localities between Voi and the coast. There are now before me specimens from the Taru Desert and Witu which are undoubtedly true *ignitus*. On the west this species was found by Mr. W. P. Lowe on the Southern Guaso Nyiro and Narossura rivers in the Nyanza Province.

2. *Acomys i. Kempi*, Dollm., has been recorded from many localities along the Northern Guaso Nyiro; the type-locality of this form is the Chandler Falls. Mr. Percival has collected *Kempi* all along the river as far as the Lorian Swamp, and in the west he has found it at Baringo and on the Larrogie Mountains and Mathews Range.

3. *Acomys i. montanus*, Hell., is only known from the specimens collected by Mr. Percival in the Marsabit District.

4. *Acomys Percivali*, Dollm., was first found on the Northern Guaso Nyiro at the Chandler Falls. Since this discovery Mr. Percival has collected this conspicuous species on the Laikipia Plateau and on Mt. Urguess (Mt. Gargues).

5. *Acomys pulchellus*, Dollm., type-locality Chandler Falls, Northern Guaso Nyiro, has been collected by Mr. Percival at Lasamis on the Marsabit Road; a specimen from as far north as Mt. Nyiro seems also to belong to this species.

6. *Acomys nubilus*, Dollm., is known only from the specimens collected by Mr. Percival at Magadi.

7. *Acomys Wilsoni*, Thos., originally described from Mombasa, has since been collected at Kitui, Voi, Taveta, Teita Hills, Tsavo River, Yata Plains, Mazeras, Taru Desert, Sagala, and the Witu Forest.

8. *Acomys W. ablutus*, Dollm., a close ally of the above, was founded on a series of specimens obtained by Mr. Kemp at Nyama Nyango, on the Northern Guaso Nyiro.

These eight forms may be arranged for identification as follows :—

A. Tail long, more than 75 mm. in length.
- a. Size of body large (head and body about 100 mm. in length).
  - a′. Colour of dorsal surface bright orange-rufous . . . . *ignitus*
  - b′. Colour of dorsal surface pale greyish sandy buff . . . . *i. Kempi.*
  - c′. Colour of dorsal surface vinaceous drab . . . . . *i. montanus.*
- b. Size of body smaller (head and body about 90 mm. in length).
  - a′. Dorsal surface pale greyish buff ; underparts pure white. Spines slender . . . . . *pulchellus.*
  - b′. Dorsal surface slate-grey ; underparts dirty grey, never pure white. Spines coarse . . . . *Percivali.*

B. Tail short, never more than 70 mm. in length
- a. Tail more than 60 mm. in length (average length 66). General colour of back dark sepia-brown . . *nubilus.*
- b. Tail less than 60 mm. in length (average length 50 mm.)
  - a′. General colour bright rufous-orange speckled with brown . . . *Wilsoni.*
  - b′. General colour drab-brown, speckled with pale buff. Size rather smaller *W. ablutus.*

TWO NEW PIGMY GERBILS FROM BRITISH EAST AFRICA

By Guy Dollman

From 'The Annals and Magazine of Natural History'

Dipodillus Percivali, sp. n.

Intermediate in size between *Dipodillus diminutus*, Dollm., and *D. Harwoodi*, Thos.

General colour of dorsal surface rather richer than in *diminutus*; on the back the effect is almost as rich as in the 'amber-brown' of Ridgway (1912), gradually becoming paler on the flanks (between 'ochraceous tawny' and 'cinnamon). Backs of hands and feet and ventral surface of body white. Tail like that of *Harwoodi*.

Skull considerably larger than that of *diminutus*, but not as large as in the Naivasha species.

Dimensions of type (measured in the flesh): Head and body 78 mm.; tail 102; hind foot 20; ear 11.

Skull: greatest length 23·7; basilar length 16·8; length of nasals 8·5; zygomatic breadth 12·2; interorbital constriction 4; breadth across brain-case 11·5; length of anterior palatal foramina 4·3; length of upper cheek-teeth (from front alveolar border to back of last molar) 3·6.

Hab.—Voi, British East Africa. Altitude 2500 feet.

Type.—Adult female. Original number 1544. Collected and presented to the British Museum by A. Blayney Percival, Esq.

This Voi *Dipodillus* is evidently more nearly related to the northern form *D. diminutus*, from the Northern Guaso Nyiro than to the Naivasha species, *D. Harwoodi*. In general dimensions it is intermediate between these two species, and in colour rather richer and brighter than *diminutus*.

This handsome little Gerbil I have named after the collector, Mr. Blayney Percival, the value of whose field-work in British East Africa it would be difficult to exaggerate.

Dipodillus luteus, sp. n.

Allied to *D. Harwoodi*, Thos., but distinguished by its very much duller and paler colour.

Size of body as in *Harwoodi*; tail rather shorter.

General colour of dorsal surface dirty drab-buff, near 'tawny-olive' (Ridgway 1912), washed over with greyish brown, the resulting effect very much paler and more subdued than in *Harwoodi*. Backs of hands and feet and undersurface of body white.

Skull slightly larger, with broader nasals and wider brain-case.

Dimensions of type (measured in the flesh).—Head and body 74 mm.; tail 94; hind foot 21; ear 10.

Skull; greatest length 26·5; basilar length 19·3; zygomatic breadth 13·5 (approximate); interorbital constriction 5·4; breadth of brain-case 12·8; length of anterior palatal foramina 5; length of upper cheek-teeth (from front alveolar border to back of last molar) 4.

Hab.—Southern Guaso Nyiro, Nyanza Province, British East Africa. Altitude 6500 feet.

Type.—Adult male, B.M., No. 13, 10, 18, 65. Original number 118. Collected by W. P. Lowe, Esq., on November 29, 1912, and presented to the British Museum by G. P. Cosens, Esq.

The pale drab colour of this form immediately separates it from *Harwoodi*, *diminutus*, and *Percivali*.

We have thus four species of the genus *Dipodillus* in British East Africa: (1) *D. diminutus*, from the Northern Guaso Nyiro (altitude 3200 feet); (2) *D. Percivali*, from Voi (altitude 2500 feet); (3) *D. Harwoodi*, from Naivasha (altitude 6300 feet); (4) *D. luteus*, from the Southern Guaso Nyiro (altitude 6500 feet).

NOTES

MIGRATION OF BUTTERFLIES

By The Rev. K. St. Aubyn Rogers

The migration of butterflies is a subject of perennial interest and one on which many more observations are needed. It may perhaps be worth while to record a migration which took place at Rabai during the early part of the present year.

The first species to be observed migrating was *Catopsilia florella*, a species which is one of the best-known migrants. The date on which the migration was first observed was March 12, and it continued for some three weeks. At no time during this period was the number of the migrants conspicuous for its large numbers, but every specimen of *C. florella* seen appeared to have important business to the north which urged it to keep moving steadily in this direction.

Towards the end of this period I noticed that there were other butterflies joining in the movement, and I spent an hour in my garden capturing these. I found that *Atella planantha* and the skipper *Andronymus neander*, the latter also previously recorded as a migrant, were represented in some numbers. However, the most interesting butterflies seen, as far I as was concerned, were a species of *Libythea* and one of *Crenis*, probably *C. Boisduvalli*. Of these I captured two of the former and five of the latter in about an hour, and as they were flying fast and high it is evident that they must have been present in some numbers. The two species resemble one another on the wing, and when travelling fast are not easy to discriminate, but I am under the impression that the *Crenis* was proportionately more numerous than these figures would indicate.

Now it is worth observing that neither of these species is common in the Coast district of B.E.A., and I had not seen the former since 1899 after a period of very prolonged and severe drought, conditions which were present to a lesser degree in the present year, and the *Crenis* I had only once before taken

in the district, though I think I saw it on another occasion. I have taken the *Crenis* twice during the present year more recently and seen others, and I have seen what I took to be a specimen of the *Libythea.*

It remains to be said that the migration throughout was from S.S.W. to N.N.E., the wind being light from the E.N.E., and also that the date of the captures was March 31. The wind went round to the S.S.W. five days later and blew strongly, the first heavy rains falling two days afterwards.

This observation seems to indicate that butterflies which are usually non-migrants may be stimulated by abnormal conditions to become migrants, and that these occasional migrations may enable the species to occupy new ground.

A WHITE KAVIRONDO

By C. M. Dobbs

In the year 1907, while on tour in North Kavirondo, I was informed by one of my personal boys that there was a Kavirondo native close to my camp whose skin was considerably whiter than my own. On going to investigate, I found a boy of about eight to ten years old, quite white. He had a most unpleasant appearance, as his body was covered with superficial sores and looked as if the skin was not thick enough and had got rubbed off in parts. The upper teeth were also very prominent. On asking if there were any other white natives in the neighbourhood, I was informed that two similarly coloured native women were in the district, but this boy was the only one I ever saw.

I do not know whether freaks of this nature are common among the natives of this country, but perhaps some of the members of the Society could give some further information on the subject and explain what actually is wrong with such persons to make them white.

THE NAKURU HARTEBEEST

As the correspondents who have written on this subject in 'The Field' do not appear to be acquainted with the original paper ('Smithsonian Miscellaneous Collections,' vol. ix., No. 8, p. 6, 1912) in which Mr. E. Heller described the Nakuru hartebeest as a distinct species, under the name of *Bubalis nakuræ*, the following extracts from that communication may be of interest.

In general characters it is described as: Similar to *B. Neumanni* of the Lake Rudolph region, but differing by lighter body coloration and narrower or less broad bracket-shaped horns; similar to *Cokei* in size and general body-colour, but feet with black band bordering hoof clefts, horns narrower, and less bracket-shaped.

The author then proceeds to state that: The Smithsonian African collection contains three specimens of this race shot near Lake Nakuru by Kermit Roosevelt. These are distinctly different from the two mounted heads of *Neumanni* from Lake Rudolph in the Tring and British Museums.

The horns of the Lake Rudolph specimen are much wider, practically the shape of those of *tora*, of which *Neumanni* appears to be a race. The Nakuru specimens, on the other hand, have less widely spread horns, more or less intermediate between those of *Cokei* and *Jacksoni* in shape, and on this account they have usually been considered hybrids between these species by sportsmen. This, however, is not the case, although they occupy a somewhat intermediate geographical position. They are found on the north-western edge of the range of *Cokei*, and are really surrounded by this species and actually removed by many miles from the nearest *Jacksoni*. The Nakuru race is known only by a single herd which inhabits the country lying between Lakes Nakuru and Elementaita. From *Neumanni*, which occupies the region bordering the north-eastern shores of Lake Rudolph, they are separated by several hundred miles.

In the forthcoming second volume of the 'Catalogue of Ungulates in the British Museum' the Nakuru hartebeest will

be admitted on the evidence of the foregoing statement, as a race of *Cokei*, adding, however, that the five skulls presented to the Museum by Captain Meinertzhagen show an almost complete gradation to skulls of typical *Cokei*. In view of the great attention Mr. Heller has paid to this difficult group, it would ill become to say off-hand that all his work is worthless, and to accept the view of the hybrid nature of the Nakuru hartebeest. The responsibility for its distinction rests, however, entirely with him. (From 'The Field.')

R. L.

NIGHT SINGING BIRDS.

In the August number of the JOURNAL, Dr. V. G. L. van Someren asks if any members have heard birds singing at night, and he mentions having heard *Pycnonotus Layardi* after dark. I have often heard not only that bird, but also one very like an English robin. There is also a small bird, with a trill almost similar to the lark, which can be heard nearly every evening after sunset, high up in the air; it is not, however, a habitant of gardens, but of open country. By the way, is not *Pycnonotus Layardi* the same as

'. . . but in divine
High-piping Péhlevi, with Wine! Wine! Wine!
Red Wine!—the nightingale cries to the Rose
That yellow cheek of hers to incarnadine,'

in the sixth stanza of Fitzgerald's Omar Khayyam? The Portuguese also give it an onomatopœic name, 'dos mille quin cent' or something very like that.

H. A. SMALLWOOD.

A CURIOUS FUNGUS GROWTH

By C. M. DOBBS

After the rains have been on for about a month, *i.e.* towards the end of April or beginning of May, I have noticed a peculiar fungus growth in this Station (Kericho) in two consecutive years.

The grass in front of the house suddenly, in a single night, becomes quite white, and it looks as if there had been a heavy fall of snow. This is due to innumerable small fungi springing up in a solid mass. Curiously the growth of the fungi synchronises with the appearance of innumerable ants, which carry out their operations over the whole area affected. Whether the ants are enticed by the fungi, or the latter are a result of some action set up by the ants, I have not been able to discover. The natives appear to regard these fungi as a great delicacy, and are very keen on gathering them and taking them off to eat.

ANNUAL REPORT, 1914.

The year that has just closed has been an important one in the history of the Society in consequence of the step the Committee has taken in engaging a Curator for the Museum.

The Committee has long been anxious to place a competent Curator in charge of the Museum ; during the last few years the material that has been received has been urgently in need of care, and has been rapidly deteriorating in consequence.

Early in the year it came to the knowledge of the Honorary Secretary that an assistant in one of the large Museums at home was anxious to come out here, and after his formal application had been received and the matter thoroughly discussed by the Committee it was decided that the Vice-President, Mr. C. W. Hobley, who was proceeding to England on leave, should conduct final negotiations with the applicant on behalf of the Society.

This has resulted in Mr. Arthur Loveridge, of the National Museum of Wales, Cardiff, being appointed Curator. But, owing to difficulties which arose in consequence of the war, he did not arrive in this country until January 2, 1915.

Mr. Loveridge comes to the Society with excellent credentials, and a record for keenness in his work which justifies the Committee in the hope that the Museum, under his skilled organisation and care, will become a credit to the Society and

those donors who have helped the Society in the past by gifts of money and specimens.

The arrangement, which has been of considerable benefit to the Society, whereby the Museum was sublet to Government as offices for the Game Warden, was terminated at the year end, the Game Warden having removed to adjacent premises.

The extension to the Museum building for which negotiations were in progress, and which was mentioned in the last report, has had to be postponed for financial reasons.

There has been a slight falling off in membership during the year, which, in view of the strain there will now be on the limited resources of the Society, it is most desirable should be made up during the ensuing year.

It is hoped that members will do all in their power to induce new members to join the Society.

It is a matter of regret to the Committee that it has not been possible to publish more than one copy of the Journal (No. 8) during the year, but it is satisfactory to be able to record that this number has maintained the reputation of the Society's publications in point of general interest.

The Committee again gratefully acknowledges the help it has received from various individuals by contributions to the columns of the Journal and gifts of specimens to the Museum.

John Sergeant,
Honorary Secretary.

EAST AFRICA AND UGANDA NATURAL HISTORY SOCIETY.

BALANCE SHEET FOR 1914.

Receipts		Expenditure		
By	Rs. Cts.	To		Rs. Cts.
Bank Balance, January 1, 1914 ..	3,469·59	Journal Publishers		420·00
Subscriptions in arrear	60·00	Rent of Museum (January 1 to December 31, 1914)		450·00
Full Members' Subscriptions, 1914 ..	1,305·00	Postage, Cheque Books, Exchange on cheques and drafts		64·09
" " " 1915 ..	15·00	Printing and Stationery		59·50
Associate Members' " 1914 ..	180·00	Museum Equipment		1,134·14
Donations	150·00	Passages and Railway Fares	Rs. 805·37	
Hire of Museum, from December 1, 1913, to November 30, 1914	600·00	Less refund on over-remittance	255·00	
Sale of Journals	36·43			550·37
		Salaries and allowances to December 31, 1914		260·00
		Advances to Curator		62·50
		Electric Lighting to August 31, 1914 ..		20·20
		Balance at Bank December 31, 1914 ..		2,795·22
	Rs.5,816·02			Rs.5,816·02

Audited and found correct,
S. J. Howarth.

W. McGregor Ross,
Honorary Treasurer.
Nairobi, *January* 18, 1915.

The Journal
OF THE
EAST AFRICA AND UGANDA NATURAL HISTORY SOCIETY

JUNE 1916 VOL. V. No. 10.

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EDITOR
C. W. HOBLEY, C.M.G.

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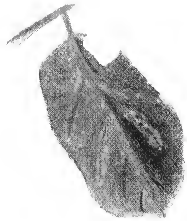
39 PATERNOSTER ROW, LONDON, NEW YORK, BOMBAY, CALCUTTA AND MADRAS

Additional copies: to members, Rs. 3 (4/-); to non-members, Rs. 4 (5/4).

♀ Ovipositing, 2/9/15, 9 a.m.

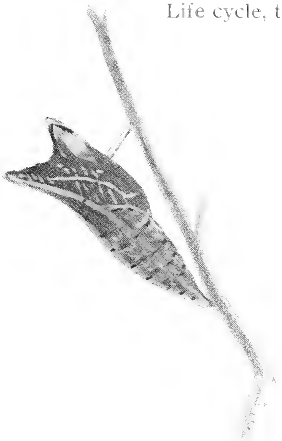
Larva
seven days old
feeding on cuticle.

Scale $\frac{1}{1}$ Larva
twenty-one days old.



Pupa.

LYCÆNID
Life cycle, thirty-eight days.



PAPILIO ANGOLANUS.
Pupa.

P. ANGOLANUS
Larva.

THE JOURNAL

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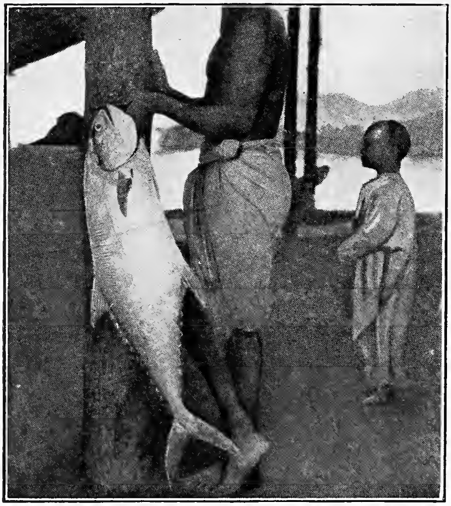
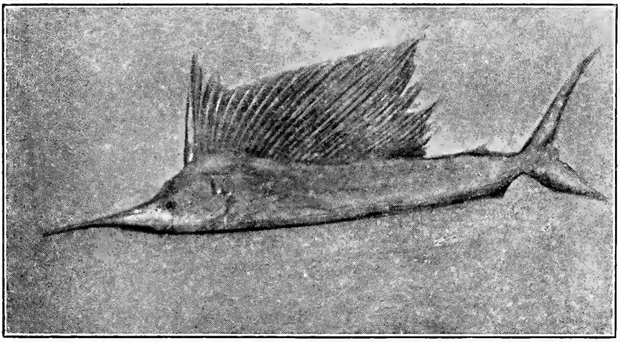
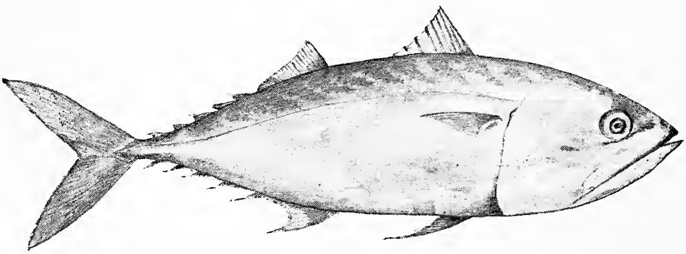


PANDU. 20 lb.



SAIL SWORD FISH (Istiophorus sp.)

THE BOWREGA *(Fam. Scombridae—Acanthanthus ?).*
Weight 9 lb.; Length 2' 6$\frac{3}{8}$"; Girth 1' 4$\frac{1}{4}$". Sc. $\frac{1}{10}$



UNA: BAIT FISH *(Fam. Scombridae).* Sc. $\frac{2}{5}$

THE GAME FISH OF MOMBASA AND MALINDI

By E. K. Boileau

Mr. Cuninghame, in his preliminary notes on the Sea Fishes of Mombasa, states that a large field for discovery lies amongst the game fishes of the coast, and subsequent investigations have amply justified his remarks.

It seems somewhat remarkable that such grand sport should have lain at the very doors of Mombasa fishermen for so long without being recognised, yet it was not until Mr. Cuninghame's first visit to those waters that such a thing as a really big game fish had been captured on rod and line (or, if captured, not recorded).

In April 1913, Dr. Small, Mr. Scott Higgins, and the writer commenced systematically to exploit the sport in the harbour waters of Mombasa and Kilindini and the reef outside, but owing to want of suitable tackle, for some time but poor results were obtained. This deficiency was soon remedied by the arrival of the necessary tarpon tackle from home, and from November to March, when the big fish came in, the sport was excellent. These few months are without exception the pick of the whole year, and very little is to be done in Mombasa waters after the south-west monsoon has broken. This, however, is not the case in the Bay of Malindi, which, being sheltered from the full blast of the wind, is comparatively calm, and becomes the home of the many small fry which constitute the diet of the game fishes.

In the present article, which, it must clearly be understood, is written for the benefit of the fisherman, and not the naturalist, it is proposed to give, after two years of careful study of the subject, as complete a list as possible of the various fish to be caught 'trolling' in the coastal waters of Mombasa and Malindi, their habits, distribution, methods of capture, and native names. The subject of bottom fishing is too vast, and presents too little attraction to the big-game fisherman,

to be attempted here, and indeed the present article is only written with a view to stimulate others to investigation and discussion, without which accurate knowledge cannot be obtained.

The following table (on the lines adopted by Mr. Cuninghame) will give a comprehensive list of the various game fish hitherto to be met with on the coast. The Swahili and Arabic names are the ones in use both at Mombasa and Malindi.

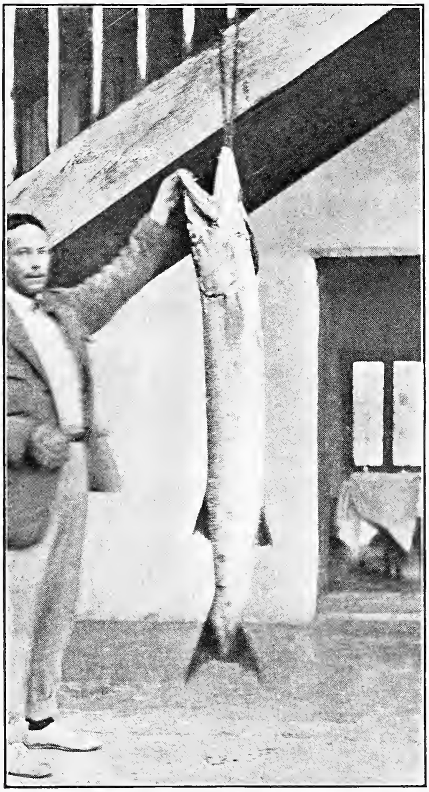
Description, Methods of Capture, &c.

King-fish, Nguru M'twana.—This fine sporting fish, to my mind second only to the barracuda, is met with all the year round in various waters on this coast, though from time to time it is only a visitor to the inland harbours. They appear to be very local, especially at Malindi, being one day abundant off Mambrui, at another off Casuerina Point, the two extremities of the bay. The local fishermen troll for them with a single sardine (large variety), the 'seemu' of Mombasa and 'dagaa' of Malindi, baited on a single hook, and obtain best results when sailing at from four to six knots. At a slower rate a number of fish are missed.

Nguru Bowrega.—This small variety of the above species seems to be a visitor to Malindi waters only, where it is to be found from time to time during both monsoons *in great numbers*, it being no uncommon occurrence for an 'ngalawa' or catamaran to bring in from twenty to thirty in a catch. The methods of capture are those employed for the larger species. When freshly landed the wavy longitudinal lines of a brown colour on the back and sides impart a very sporting look to this graceful fish. It does not appear to exceed 15 lb. in weight. I have not heard of its appearance in Mombasa waters.

Barracuda.—This is undoubtedly the finest fighting fish on the coast, although his reputation as such bids fair to be wrested from him when a true bonito or tuna [1] is taken on rod and line, and my experience of these two on a hand line leads me to believe that such will be the case.

[1] Since writing the above, a bonito has been caught off Mombasa, and although only 11 lb. in weight amply justifies the above remarks.



BARRACUDA (MZIO). 57 lb.
Length 5′ 6½″.

The barracuda can generally be recognised when hooked by his clean rushes on the surface of the water—he rarely sounds, and is full of grit to the finish. The natives recognise two varieties, the larger of which, the 'Mzio,' is the subject of the accompanying photo.[1] I have as yet been unable to distinguish any difference, except in size, but both Mombasa and Malindi fishermen are unanimous that two species exist.

Koli-koli. The Kambesi.—This appears to be the largest member of its family, and must attain a weight of quite 120 lb. I have myself seen a specimen in the Malindi market weighing 3 frasilas (108 lb.). It is distinguishable from the koli-koli by its dark colour (in very large specimens approaching black) and blunter head. I am convinced that both Mr. Aflalo's 64 lb. and Mr. MacMillan's magnificent fish of 72 lb. were kambesi and not koli-koli.

Both fish are annual, but are more plentiful in the north-east monsoon. They are taken freely by trolling, but the natives catch more at anchor, or drifting in very deep water, baiting with a sardine (either alive or dead) on a single hook passed through the eye. The kambesi gives very little fun when hooked—persistently boring at great depth.

Koli-koli, of a much lighter colour and build than the above, and when freshly taken shows beautiful iridescent hues of green and pink. Like his larger brother, he is a somewhat heavy fighter and given to boring. The flesh is excellent.

Wai (plural *Mawai*).—As far as I can judge, a visitor to Malindi waters only during the months of September, October, and November. In coloration and forms the same as the koli-koli, but with five to six vertical black stripes, much resembling but narrower than our English perch—the spots of the koli-koli are also absent. The mouth is more fleshy and more protruding than in either of the above two species, which render it very difficult of capture, breaking away at once with rough handling.

Although taking a moving bait, the natives fish for it with a single sardine of the smallest variety (kumbu), and use

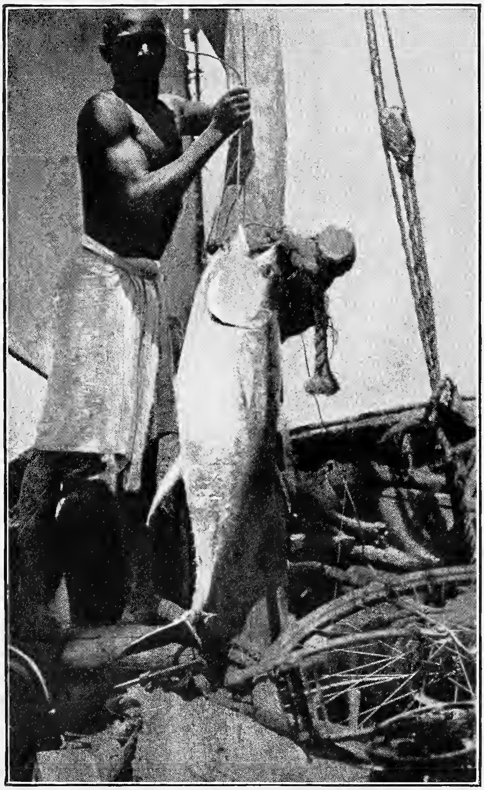
[1] By an error, due, I understand from Mr. Cuninghame, to photographs having been mixed up, the photo of a king-fish (*frontispiece*, Vol. III. No. 5) is described as a barracuda.

only a small hook mounted on a strand of fine brass wire. It is admitted by them to be cunning and difficult of capture.

Bonito.—As far as I know, this, the true bonito, has not been caught on rod and line by any fisherman in East African waters (see remarks on page 66). I have repeatedly seen small specimens in the Malindi market up to 15 lb. weight, generally after a very windy day, as the natives say they only capture them whilst sailing at a high rate of speed. There is no doubt that they reach a weight exceeding 50 lb., but I have not, so far, seen anything approaching this in local waters, but have caught them up to 30 lb. at St. Helena and to 46 lb. in the Indian Ocean from the bowsprit of a full-rigged ship.

Tuna.—Yellow-finned. I have only seen one specimen of this fish, the subject of the photograph, which was caught by me, trolling with a hand line from the stern of a dhow, on a voyage between Ras Ngomene and Kipini. It weighed 31 lb. six hours after capture, and fought very gamely, but showed none of the tuna characteristics of jumping, probably owing to the rate at which the dhow was travelling and the unceremonious manner in which it was handled. They are said to be found, in the north-east monsoon; in numbers off Watamu, but I have not verified this. Apparently they are essentially deep-water fishes; and do not appear to come close in shore. Both this fish, and the bonito, however, are far from common and seldom caught, and fishermen seem to disagree widely as to the native names, applying the name 'd'jodari' indiscriminately to both fish, the name 'sahayawa' being said by some to be the Arabic equivalent to 'd'jodari.' Information on this subject is badly needed, as some assert that there is another and third variety of the d'jodari.

The Pandu.—Mr. Cuninghame in his list gives the maximum weight of this fish as 4 lb., but they are commonly to be seen in Malindi fish market up to and over 20 lb. In these big specimens, the belly is coloured a most brilliant yellow, which is absent in the smaller fish, although the 'five finger marks' on the sides are present from youth to old age. They breed in these waters. He is a game fighter; but generally ends in boring.



TUNA or ALBICORE (D'JODARI). 31 lb.

The Dolphin.—These brilliantly coloured and exceedingly game fish give the greatest fun on a light rod. They always move in shoals, and take greedily almost any moving bait. When fishing for them the natives have a number of spare lines ready baited, and when one is hooked these spare lines are immediately thrown overboard, and it is no uncommon sight to see every member of a boat's crew fast in a fish at one and the same time. They play more out of the water than in, and a really big one (they grow to 30 lb.) should give exceptional sport.

The Gar-fish.—Frequenting inland waters, in which they breed, more than most of our coastal game fishes, the gar-fish may be captured when rough weather at sea precludes other sport. He takes a spoon and other moving bait readily, and jumps clean out of the water when hooked. I do not know up to what weight this fish runs ; the biggest I have ever seen was one caught by Dr. Small at the entrance to Mombasa harbour, which weighed 8 lb. though over four feet in length.

That they grow to a much larger size is evidenced by the fear in which they are held by the natives, who state that when being hauled up to a boat they leap straight at their captor, inflicting dangerous wounds with their long slender beak. This statement is vouched for by Dr. Massey of the East Africa Protectorate service, who told me that in the West Indies he had attended cases of dangerous wounds (resulting in one case in death) inflicted on native fishermen by gar-fish there. The flesh is very delicate, and can always be recognised on the table by its green bones.

There appear to be two varieties in these waters.

The Sword-fish.—This extraordinary-looking fish was first brought to my notice by Dr. Maula Bukhsh, medical officer at Malindi, who showed me a dorsal fin (cut from a recently killed specimen) which measured roughly three feet high by two feet long. This was a year ago, since when four others have been brought in to the Malindi market, one being the subject of the photo published.

Unfortunately I was away at the time, and Mr. L. C. Wright, of the Survey Department, to whom I am indebted for the photo, omitted to take any measurements, but judging

from the photo, it could not have weighed less than 80 lb. This was stated to be a *small one* !

Günther (p. 432) states that sword-fishes attain to a length of from twelve to fifteen feet, and native fishermen at Malindi assert that they frequently have to cut away their lines when a large specimen is hooked, so fierce are their attacks on the boat.

The ventral fins, which are in the form of two long styliform appendages, fit into a deep groove in the belly extending to the vent, which would seem to be a provision of nature to permit of the fish resting on the bed of the ocean, for, owing to the length and bony nature of these fins, this would otherwise be impossible. The Swahilis give them the name of 'Frasi ya Bahari,' and the Arabs that of 'Sulsuli.' They are taken trolling. In calm water they are said to erect the dorsal fin and to sail on the surface.

Whilst the above list comprises what may be termed the game fishes of Mombasa and Malindi waters, or at least those that have come under the personal notice of the writer and from exhaustive inquiries from natives, there are several species of Sparidae and Percidae that occasionally take a moving bait. Drifting along slowly on a calm morning, I have repeatedly hooked and landed specimens of both these families ; and only quite recently when entering Mombasa harbour and sailing with a strong following wind at quite seven knots, I hooked and landed a red fish, weighing 11 lb., which I took to be a species of Lethrinus.

When 'trolling' with rod and line becomes more popular in Mombasa waters (and there are signs of its rapidly becoming so), no doubt more varieties will be added to our already varied list of sporting fishes. Very little help in this direction, I fear, can be obtained from native sources, but readers can assist materially in forwarding any photos or measurements of fish (caught in the above manner) to the editor for publication in the Journal.

The main points essential for scientific classification are :

1. The number of spines and rays in dorsal and anal fins.
2. Number of scales from gill opening to caudal fin along lateral line.

3. The number of scales in a line running from the commencement of the dorsal fin or the middle of the back to the lateral line down to the vent or ventral fin or the middle of the abdomen.

For instance, the following formula would represent the scales between the head and caudal fin: L. Lat. 40; whilst the formula L. Transu $\frac{8}{5}$ would represent those eight longitudinal series of scales above the lateral line and five below those same.

I hope to be able in my next article to give a few hints with regard to tackle, bait, native methods of dressing line, &c.

GAME AND WAR

By C. W. Woodhouse

This article only proposes to deal roughly with observations made in peace time and those noticed during the first year of the war in British East Africa, with regard to the various game animals normally present on the scene of the present hostilities in the Mombasa military area, i.e. from the Kitirua and Engumi waterholes, i.e. Lake Njiri (Ologinya) District, Southern Masai Reserve, to Mount Rukinga near Kasigau.

The Taru desert is apparently unaffected. On making a brief survey of the terrain, the country is found to consist of several well-marked types which may be classified as:

1. The open grass lands, i.e. the Masai country from Lake Njiri to the Rombo river and from the Anglo-German border to the lava beds at the foot of the Chyulu Hills. Very similar country, though with rather more bush, is to be found from Campi Ya Bibi, five miles west of Maktau, to near the Lanjoro drift.

By the definition 'open grass lands' it must not be taken to mean absolutely bare rolling plains like the Nairobi, Athi, and Kapiti plains, but, with the exception of the Kuku plain, open grass land must be regarded as parklike country capable

of grazing cattle and with occasional patches of scrub. The whole of the grass land is interspersed with solitary thorn trees.

The country seen from the Uganda railway near Kiu approximates to this sketch of country.

2. The 'bush country,' i.e. the country along the Tsavo river as far west as Mzima, and then on its right bank up to the Ziwani swamp. The country from Voi westwards to Campi Ya Bibi and from the Tsavo river to Rukinga and from the Uganda railway to the Chyulu Hills. This also includes the bush from Salaita Hill to Lake Jipe at present temporarily occupied by the enemy.

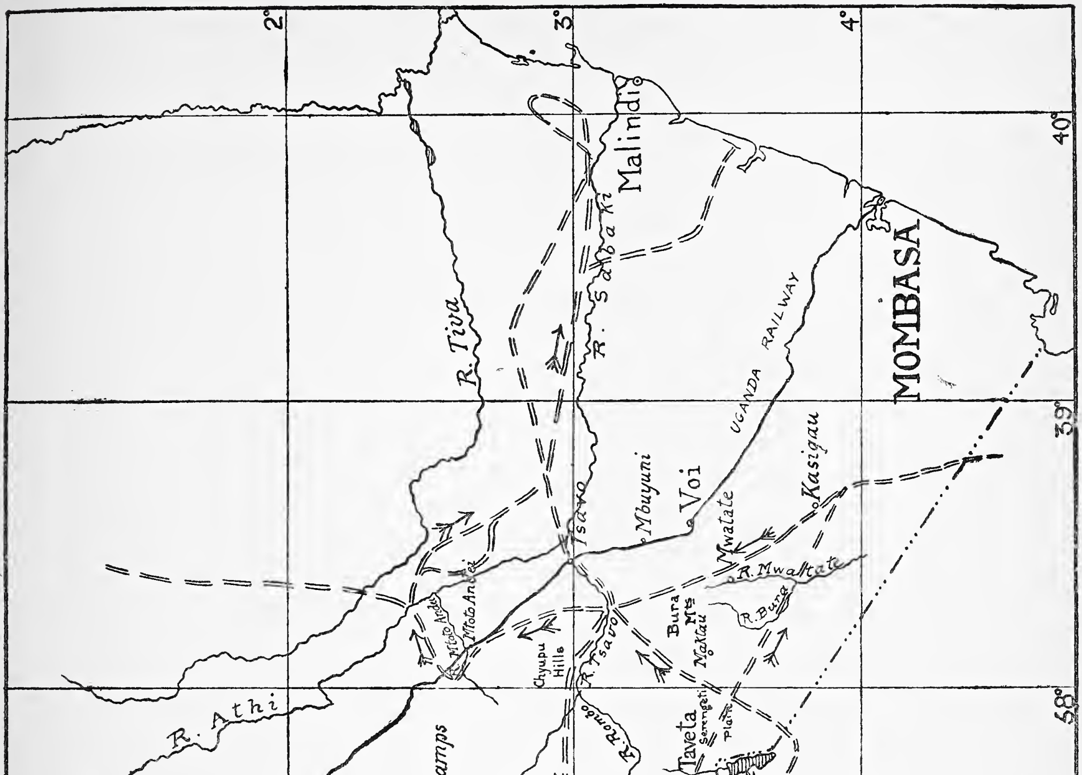
The more important game occupying these areas are as follows:

Elephant	Coke's Hartebeeste
Rhinoceros	Wildebeeste
Buffalo	Impalla
Hippopotamus	Zebra
Lion	Grant's Gazelle (Serengetti and Typica)
Leopard	Thomson's Gazelle
Eland	Giraffe
Greater and Lesser Kudu	Ostrich
Gerenuk	

Naturally when large bodies of men are encamped and are constantly moving about in areas which before the war were practically deserted, when these large bodies of men have at certain times to rely on game for food, when certain animals, such as rhinoceros, have to be destroyed on their endangering troops on patrol, and when at irregular intervals heavy rifle and maxim fire takes place, the local fauna becomes disturbed, and either changes its feeding-grounds or becomes destroyed. This is most noticeable in several animals, viz. elephant, rhinoceros, buffalo, and lion.

Taking these animals separately:

Elephant.—The normal migration of the elephant appears to keep to the following general lines: At the start of the long rains the elephants leave the Kilimanjaro forests and move down into the plains, one party coming *via* Lake Jipe,



Elephant migrations: =

from whence the herd divides, part moving direct to the Upper Tsavo, others moving over to the Lower Bura and Mwatate rivers, perhaps *en route* visiting Kasigau. The others, passing Laitokitok through the L'Endim Lo Soit (Stony Forest), come down into the Tsavo river between Kivukuni and Mzima, and work down towards Campi Ya Tembo. These elephants feed in the thorn scrub north and south of the river, crossing down to the Tsavo at night to drink. In this scrub they are either joined or followed by the Bura-Mwatate herds.

The elephants then pass north *via* the Chambui spring to the Mtito Andei river, thence crossing the Uganda railway and proceeding to the Athi river perhaps as far as the Tiva river.

The herds then move south-west along these streams and visit the hill Rovuma in the Girvama country, and some members of the herds raid the Malindi plantations.

Few, if any, of these elephants in the war zone have been shot either by British or Germans, but the presence of troops has disturbed them considerably.

In 1914 the annual migration took place, but in 1915 only a few scattered small herds came over and along the Tsavo, and except for two or three small herds in the lower reaches, elephants have been conspicuous by their absence. These elephants only come to the river to drink, and speedily make off. (Note.—It must be noted that the elephants north of the Uganda railway may be recruited from the Wakamba District elephant herds.)

Rhinoceros.—A large number of rhinoceros have been shot, especially by the enemy. Regular rhinoceros parties used to go out from Taveta and Salaita to kill rhinoceros with, it appears, the double object of providing meat for African troops and sport for the German officers.

Thus the large number of rhinoceros which used to exist in the Upper Rombo, Ziwani Swamp, the bush fringing the Taveta Forest, Lake Jipe, on Latema, Reata, the Mokinni Hills, and in the Kitovo Forest may be taken to be nearly extinct.

On the British side a fair number have been shot when

charging patrols and bodies of troops, and doubtless many more have escaped after being wounded. The large number of rhinoceros which used to live in the bush north and south of the Tsavo river have been much reduced, but probably numbers of these have moved down to the Athi river.

As an instance, the writer counted fifty-four different fresh tracks between Tsavo station and the mouth of the Rombo in 1913, and on an early patrol (August 1914) during the war, saw eighteen in three hours from Kivukoni while travelling due south, but at the present moment only an odd rhino is to be seen or heard. Many still exist, but they are much reduced in numbers.

The rhinoceros are much reduced or have migrated to a large extent on the Serengetti Plains, especially near Maktau.

Buffalo.—The large herds of buffalo along the Tsavo river, especially those on the north bank, appear to have moved back into the Chyulu and Nbulia Hills.

Lion.—Few lions were apparent on the Serengetti (1914–1915), and they appear to have practically left those parts of the Tsavo river where formerly they were common. As far as can be ascertained, very few lions have been shot in the Mombasa area by our troops.

Giraffe.—A fair number have been shot for food, but they will certainly quickly recuperate after hostilities.

Eland.—The writer is of the opinion that the numerous wild dog have caused far more damage to the eland than the few shot by the military. The wild dog nuisance also applies to other game.

Hippopotamus.—A certain number of hippopotamus have been killed in the Mzima river, but these will later be speedily replaced from the Athi. The Mzima river is a noted breeding-ground for hippopotamus, but the majority of hippo there are migratory.

Greater and Lesser Kudu.—Far more Greater Kudu have been shown to exist than was previously imagined in the Mombasa area.

They are fairly generally distributed over a large area, but are very shy and semi-nocturnal.

Of the remaining game animals, the gerenuk about Campi

Ya Bibi and Mbuyuni and along the Tsavo river appear to have disappeared (probably migrated), and the large herds of impalla along the Tsavo have nearly all gone.

On the contrary, the greater and lesser kudu and the buffalo near Killakuni have undoubtedly increased, many calves having been seen.

To sum up, it may be stated that the war has seriously disturbed the game from their usual haunts, but with the exception of the rhinoceros, who, it is feared, will never recover, the damage is only temporary.

The above remarks, be it understood, only apply to the Mombasa area, and in no way apply to the area of country including Ol Doinnyo Erok, the Ol Egeju, L'Ado, or the Bissi river.

October 1915.

REPORT ON THE COLLECTION OF OPHIDIA IN THE SOCIETY'S MUSEUM

By A. Loveridge

It has been suggested that it would be well to publish from time to time in the Journals, lists of the specimens in the Museum, so that members and others may know what species we are in need of and assist the Society to complete its series by filling up the gaps. In future numbers we hope to publish lists of the Mammals, Birds, Lizards, &c.

It is greatly to be regretted that in the present list of snakes lack of space renders it impossible to place the donor's name opposite each specimen, as will be done in future lists. The best collections which have been received are those of Mr. H. J. A. Turner from Kakumega District, B.E.A., and the Hon. C. W. Hobley's collection from Kitui District. In the following list only snakes found in B.E.A. or Uganda are listed ; there are a number of other species in the collection from West and South Africa, but these are omitted. A number of the specimens had been sent to the British Museum for identification last year, and these I brought back with me

in January. The Society is therefore indebted to Dr. Boulenger for determining all those in the following list marked with an asterisk.

There are no new species to record, but quite a number of interesting variations in scalation worth recording. The second and third columns record the length of body and tail respectively, the fourth the number of encircling scales at mid-body. For the benefit of members I might add that the ventrals are the broad scales along the belly (wanting in burrowing forms such as *Typhlops* and *Glauconia*). Caudals or sub-caudals are beneath the tail, and are usually paired. The number of scales bordering the upper lip (labials) are recorded in the last column, and where there are two numbers given it shows an azygous condition of scalation on the right and left sides. The letter ' M ' after the length of the tail implies that that member has been mutilated and part of it is missing, which, it must be remembered, renders valueless the corresponding number of caudals.

Tropidonotus olivaceus (Banded Olive Snake).—The shortness of the tail in I 25 is remarkable. It is probable that the end is missing, but the stump has healed over so remarkably and become pointed that no trace of injury can be seen. Snakes, unlike lizards, do not regenerate their tails.

Boodon lineatus (Brown House Snake).—Most of the males in the collection are olive in colour, the larger females are plumbeous ; there are quite a number of light sandy-brown specimens. By the numbers sent in to the Museum it would seem to be the commonest species. I think, however, that *Chlorophis neglectus* is commoner, but does not come under notice so much, as it spends most of its time in shrubs and bushes, away from the haunts of man and in the neighbourhood of streams.

Lycophidium capense (Cape Wolf Snake).—The range of ventral scalation as given in Boulenger's ' Catalogue of Snakes ' is 164–189 ; this can now be extended to 162–202. I 410 has also 26 caudals.

Pseudaspis cana (Mole Snake).—In I 218, the fifth, not fourth, labiale nters the eye. Boulenger states, ' Sub-caudas 50–70,' whilst our four young specimens have respectively 39, 40, 43, 43 caudals. The range may therefore be increased 39–70.

Chlorophis (Green Snakes).—In the series of this genus from Kakumega we have some interesting irregularities. In the 'Catalogue of Snakes,' Vol. II, the description of the labials in *emini* is 'nine upper labials, 4th, 5th, and 6th entering the eye.' In *hoplogaster* 'eight upper labials, 4th and 5th entering the eye.' As will be seen from the data of one of our specimens of *emini* (I 38), there are nine labials on one side of the head and eight on the other; again, in I 39 there are nine and seven, whilst in two undoubted specimens of *emini* there are seven on both sides. In I 39 on the right side (7 labials) 3rd, 4th, and 5th enter the eye, the left side is normal. The same thing occurs in I 37. Andersson[1] refers to a similar scalation in a specimen of *emini* he obtained at Khartoum, but in his snake it is the left side that has eight labials, the right being normal. The two specimens, I 42 and I 43, might be referred to either species—*emini* or *hoplogaster*. In the number of ventrals and sub-caudals they incline to *emini*, but in labials to *hoplogaster*, for in I 42, 4th and 5th enter eye on the right side; 4th, 5th, and 6th on left. I 43, 4th and 5th enter on left side, and the right side is damaged. Just on going to press I have received from Mr. Turner nearly fifty examples of these two species from the Yala river. These I have carefully examined.

Thirty-two of these were *C. emini*, of which seventeen were normal on the basis of two labials entering eye; the last specimen should be referred to *hoplogaster* were it not that the caudals number 112.

Number of Specimens	Number of Right Labials	Labials Entering Eye	Number of Left Labials	Labials Entering Eye
17	9	4, 5, 6	9	4, 5, 6
1	10	4, 5, 6	10	4, 5, 6
1	10	4, 5, 6	9	4, 5, 6
1	9	4, 5, 6	10	5, 6, 7
4	9	4, 5, 6	8	4, 5, 6
1	9	4, 5, 6	8	4, 5
5	8	4, 5, 6	8	4, 5, 6
1	8	4, 5, 6	7	3, 4, 5
1	5	2, 3	5	2, 3

[1] *Results of the Swedish Zoological Expedition to Egypt and the White Nile*, 1901, by L. G. Andersson.

Of the fifteen specimens of *C. hoplogaster* fourteen were normal, i.e. 8 labials on both sides, with the 4th and 5th entering eye. The abnormality consisted in labials being 9–8; 5th and 6th entering eye on the right side.

It seems highly probable that cases of interbreeding must occur between two so nearly related species inhabiting the same locality; on the other hand, the slight differences may be individual, and not specific. I am inclined to think that the two species merit specific rank, but that the labials are so liable to fusion and division that they are valueless for purposes of determination. In the near future I hope to obtain a number of living specimens to see if they interbreed in captivity and solve the question by an examination of their progeny.

Chlorophis neglectus (East African Green Snake).—Ventrals 149–173, caudals 77–126, instead of 'Ventrals 149–166 and caudals 77–114.'

Thrasops Rothschildi.—Our example of this scarce and recently described snake has 117 caudals as against 141 of the type.

Dasypeltis scabra (Egg-eating Snake).—This snake is extraordinarily variable in colouring; there are specimens of jet black, dark brown, and grey in the collection. In the Fort Hall district all the specimens I have seen were ringed with white speckles very similar to those in *Leptodira hotamboeia.* Mr. T. D. Nair sent in an interesting colour variation (I 341) which he assures me is quite common in the Giriama country; it has not been described to my knowledge:

Dorsally pinkish brown, each scale with two microscopic black specks at tip, laterally scales are vivid pink, the two outer rows of scales, like all the ventrals, freckled with white dots. Gular shields, as also anterior ventrals, white, gradually merging into pink posterior ventrals. Head scales pinkish brown, the frontal and parietal scales with faint traces of the typical markings. Upper labials pinkish except on the buccal border, thickly peppered with minute black spots. Lower labials pure white.

Tarbophis guentheri (I 132).—This specimen agrees with *T. obtusus* in having 23 scale rows instead of 21, but it possesses an entire anal.

Hemirhagerrhis Kelleri (I 100).—The 3rd, 4th, and 5th labials enter the eye. Ventrals are 188 as against 147–173; caudals 57 as against 61–78.

Rhamphiophis oxyrhynchus.—In the Catalogue of Snakes 110 is given as the maximum for caudals, whereas two of our specimens have 117 and 116 respectively.

Psammophis brevirostris (Short-snouted Sand Snake).—Ventrals given as 153–163 and caudals as 64–95 should be extended, 153–181 and 57–95.

Dispholidus typus (Boomslange or Tree Snake).—Another of the thirty-three South African snakes whose range extends to B.E.A. The very fine series collected by Mr. Turner from one locality show well the encroaching of black spots on the green scales, so that the same species may have a vivid green or jet black phase.

Micrelaps vaillanti.—The type, locality, and recognised habitat of this rare snake is Somaliland; unfortunately no data accompanied the specimen which I found at the Museum; it has 23 ventrals in excess of the maximum.

Dendraspis Jamesonii (Mamba).—I 195 is the head referred to by Sir F. J. Jackson in the *Journal*, Vol. IV, No. 7. Four of the Kakumega specimens are much lower than the minimum number of 99 caudals.

Bitis arietans (Puff Adder).—There seem to be three colour phases—a brick-red, a nut-brown, and a lemon-yellow. The eggs (I 398) were taken from a female killed on West Kenia; I removed 24 eggs from the right ovary, 14 from the left.

Atractaspis irregularis (Burrowing Adder).—Scales in 23 instead of 25 rows. Caudals 30 as against the maximum of 27.

Species still Required for the Museum Collection

Mr. Hobley has asked me to add a note on collecting snakes. They may be readily killed by a blow across the back; the head should on no account be struck, and the less it is battered the better the specimen. Unfortunately, many persons mistake the after-death muscular contortions as signs of vitality, and keep hammering away till there is little left to move. If caught alive, snakes will readily succumb to chloroform.

As soon as possible after death an incision should be made in the throat, another in the stomach region, and a third just anterior to the vent. The viscera may then be cut transversely with a pair of scissors, and can then be easily removed, when the snake will preserve much better. It can be kept in a 5 per cent. formalin and water solution or in methylated spirits. It is important not to crowd it into a small bottle for the first three or four days, and it should not be left in a strong light, or the colours will fade. The locality and date are important, and can easily be scribbled on a piece of stamp-paper, but most people will not take this trouble.

Typhlops.—There are at least half a dozen species found in the Protectorate of which we have no examples. These blind snakes are very worm-like in appearance and habits. The mouth is a semicircular slit on the underside of the head; head and tail are very much alike.

Glauconia.—Externally very similar to *Typhlops*, but distinguished by the absence of teeth in the upper jaw. Several species have recently been recorded from German East Africa and Somaliland, and it is highly probable that undescribed species are to be found in this country.

Colubrines.—There are about thirty-four species which have been recorded from B.E.A. or G.E.A. yet required; most of them are small, insignificant snakes. The chief desiderata among the front-fanged species are *Hydrus platurus* (black and yellow sea-snake), an eel-like reptile that has been occasionally cast up upon the coast; the tail is flat and rudder-like. *Elapechis niger* from Zanzibar, a sluggish and evil-looking snake with very small eyes, about two feet in length. *Dendraspis angusticeps* (common black or green mamba), which has been recorded from Mombasa and Taveta; it attains a length of thirteen feet, but is comparatively slender. With its near relatives it enjoys the reputation of being the most deadly snake in Africa; it is very active and has no hood. It is a common error in B.E.A. to apply the name 'Mamba' to the black-necked cobra (*Naia nigricollis*).

Viperines.—Our series of this family is almost complete with the exception of the burrowing vipers (*Atractaspis*), of which there are six not represented. *Causus defilippi*

(snouted night adder) is also required. A Uganda specimen in good condition of the beautiful *Bitis gabonica* (Gaboon viper) and a specimen of the recently described green tree viper, *Atheris woosnami,* from Ruwenzori, will complete the Viperidæ of British East Africa in the Museum Collection.

Localities.—Collections made on the German border, Tana river, Northern Guaso Nyiro, Jubaland, and Uganda will be certain to contain valuable material.

LIST OF THE OPHIDIA IN THE SOCIETY'S COLLECTION, DECEMBER 1915

TYPHLOPIDÆ

Typhlops								
*punctatus** .	147	11	$\frac{1}{4}$	30	—	—	—	Kitui Dist.
punctatus .	253	$10\frac{3}{8}$	$\frac{1}{4}$	25	—	—	4	Nr. Nairobi.
punctatus .	102	$5\frac{3}{8}$	$\frac{1}{8}$	30	—	—	—	—
punctatus .	361	5	$\frac{1}{8}$	22	—	—	4	Mombasa.
*schlegelii** .	148	$11\frac{1}{2}$	$\frac{1}{4}$	36	—	—	4	Kitui Dist.
pallidus .	142	$8\frac{7}{8}$	$\frac{1}{8}$	22	—	—	4	Mombasa.
unitæniatus .	344	$9\frac{1}{8}$	$\frac{1}{8}$	25	—	—	4	Jilore.
unitæniatus .	128	$8\frac{1}{2}$	$\frac{1}{8}$	25	—	—	4	Kismayu.

GLAUCONIDÆ

Glauconia								
emini . .	348	$10\frac{3}{8}$	1	14	—	—	3	Jilore.
emini . .	342	$9\frac{3}{4}$	$\frac{7}{8}$	14	—	—	3	Jilore.
emini . .	254	$7\frac{1}{4}$	$\frac{3}{4}$	14	—	—	—	Kyambu.
emini . .	245	7	$1\frac{1}{8}$	14	—	—	—	Parklands.
emini . .	255	$4\frac{5}{8}$	$\frac{1}{2}$	14	—	—	—	Kyambu.
nigricans ? .	326	3	$\frac{3}{8}$	14	—	—	4	Mombasa.

PYTHONIDÆ

Python								
sebæ (skin) .	146	174	17	—	—	—	—	Machakos.
sebæ (tank) .	145	124	15	86	272	72	14	Athi River.
Eryx								
*thebaicus** .	149	$25\frac{5}{8}$	$1\frac{5}{8}$	53	182	21	13	—
thebaicus .	129	11	$1\frac{3}{8}$	48	173	27	13	Kismayu.
*thebaicus** .	150	$9\frac{7}{8}$	$1\frac{1}{8}$	51	162	24	13	—
thebaicus .	97	$9\frac{3}{4}$	$1\frac{1}{8}$	46	165	23	13	—
*thebaicus** .	151	6	$\frac{5}{8}$	47	162	24	12	—
*thebaicus** (head)	132	—	—	—	—	—	—	Taveta.

COLUBRIDÆ (*COLUBRINÆ*)

Tropidonotus								
olivaceus .	24	$17\frac{1}{2}$	$4\frac{5}{8}$	19	147	53	8	Kakumega.
olivaceus .	25	$13\frac{3}{8}$	$1\frac{1}{4}$	19	147	28	8	,,
olivaceus .	26	$11\frac{3}{4}$	$2\frac{3}{4}$M	19	145	43	8	,,

Boodon								
lineatus	308	35	5	33	227	52	8	Nakuru.
*lineatus**	159	34¼	4¼	33	233	52	8	Kitui Dist
lineatus	256	30¾	4¼	31	238	48	8	Kyambu.
*lineatus**	160	29½	4⅛	33	225	53	8	Kitui Dist.
*lineatus**	154	28⅛	4¾	35	233	47	8	—
lineatus	296	27½	4 M	34	232	51	8	Kabete.
lineatus	374	25⅜	3⅞	33	237	54	9–8	Nairobi.
lineatus	27	25	3¾	30	234	52	8	Kakumega.
lineatus	257	24¼	4¼	31	210	53	8	Kyambu.
*lineatus**	156	24	3⅝	35	239	52	8	—
*lineatus**	155	23⅝	4⅝	31	217	41	8	—
lineatus	88	23¼	3¾	31	225	53	8	—
lineatus	28	23	4½	30	221	63	8	Kakumega.
lineatus	136	22½	4¼	23	220	59	8	Kyambu.
lineatus	309	22¼	4	33	220	56	8	Nakuru.
lineatus	258	21⅝	4¾	31	207	58	8	Kyambu.
lineatus	336	20½	4	31	212	62	8	Parklands.
lineatus	310	20½	3¾	33	225	59	8	Nakuru.
*lineatus**	163	20¼	4¼	33	217	70	8	Machakos.
*lineatus**	161	20⅛	2¾M	33	215	39	8	Mutha.
lineatus	90	19	4¼	29	211	65	8	—
lineatus	89	18¾	2⅞	29	230	55	8	—
lineatus	259	18½	2½	31	240	50	8	Kyambu.
lineatus	76	18¼	4⅛	31	216	69	8	Nairobi.
lineatus	311	18	3⅝	33	221	72	8	Nakuru.
lineatus	404	17	4	29	200	66	9–8	Voi.
lineatus	380	18¾	2¾	26	170	53	8	Jilore.
lineatus	29	15¾	2	30	227	51	8	Kakumega.
lineatus	30	15½	2⅞	30	212	66	8	Kakumega.
lineatus	31	15⅛	3	30	219	67	8	Kakumega.
lineatus	75	14½	2⅞	33	224	68	9	Nairobi.
*lineatus**	153	14⅜	2⅛	31	231	54	8	Nairobi.
lineatus	260	13⅛	2	31	230	53	8	Kyambu.
lineatus	32	12¾	2¼	30	203	63	8	Kakumega.
*lineatus**	158	9	1⅞	30	217	68	8	—
*lineatus**	162	9	1⅞	33	235	56	8	—
lineatus	91	8¾	1⅜	29	219	54	7–8	—
lineatus	85	8½	1½	27	209	53	8	Mombasa.
lineatus	130	6¾	1½	27	194	68	8	Kismayu.
Lycophidium								
capense	368	16½	1⅞	17	185	30	8	Nairobi.
capense	339	14⅛	3	17	202	55	8	Jilore.
*capense**	166	12½	1⅜	17	186	28	7–8	—
capense	410	11	1¼	17	162	26	7	Mombasa.
*capense**	165	10½	2	17	194	43	8	Kitui.
capense	340	5⅞	¾	17	158	38	8	Jilore.
Pseudaspis								
cana	218	41⅜	9	29	184	50	7–8	Nakuru.
cana	314	15⅜	2½	27	186	51	8	Nakuru.
*cana**	206	14⅛	1¾	29	205	43	7	—
*cana**	204	11½	1½	29	175	40	7–8	Kitui Dist.
*cana**	205	11½	1½	29	172	39	7	—
cana	315	9⅞	1⅜	29	182	43	8	Nakuru.
Chlorophis								
emini	34	20	10	15	169	126	9	Kakumega.
emini	35	18½	8¼	15	185	110	9	,,
emini	36	16	7¾	15	179	118	9	,,

Chlorophis (*cont.*)								
emini . .	37	12	6	15	179	122	8–9	Kakumega.
emini . .	39	$10\frac{7}{8}$	$4\frac{3}{4}$	15	181	116	7–9	„
emini . .	41	$10\frac{1}{2}$	$4\frac{1}{8}$	15	179	112	7	„
emini . .	38	$9\frac{5}{8}$	$4\frac{1}{2}$	15	179	115	7	„
emini . .	40	8	$4\frac{1}{2}$	15	178	117	8	„
sp. . .	42	$19\frac{3}{4}$	9	15	178	116	8–9	„
sp. . .	43	$11\frac{3}{4}$	$5\frac{1}{8}$	15	183	109	8	„
hoplogaster .	46	$24\frac{1}{2}$	$9\frac{3}{4}$	15	166	96	8	„
hoplogaster .	44	$22\frac{3}{4}$	$9\frac{1}{4}$	15	165	97	8	„
hoplogaster .	45	22	$8\frac{3}{4}$ M	15	168	79	8	„
neglectus .	320	$29\frac{1}{2}$	$8\frac{1}{8}$ M	15	171	64	8	Nakuru.
neglectus .	371	24	10	15	167	110	8	Nairobi.
neglectus .	392	24	$9\frac{1}{2}$	15	172	95	8	Tumu Tumu.
neglectus .	312	22	$11\frac{1}{4}$	15	163	113	8	Nakuru.
neglectus .	362	$21\frac{3}{4}$	$11\frac{7}{8}$	15	165	125	8	Nairobi.
neglectus .	363	$21\frac{3}{4}$	$6\frac{5}{8}$ M	15	168	63	8	„
neglectus .	303	$20\frac{7}{8}$	$9\frac{5}{8}$	15	168	112	8	„
neglectus .	364	$20\frac{3}{4}$	$9\frac{3}{4}$	15	165	116	8	„
neglectus .	372	$20\frac{1}{4}$	9	15	163	112	8	„
*neglectus** .	169	$20\frac{1}{8}$	8 M	15	166	88	8–9	„
neglectus .	234	$19\frac{7}{8}$	$9\frac{1}{4}$	15	173	113	7–8	„
neglectus .	219	$19\frac{3}{4}$	$8\frac{3}{4}$	15	165	116	8	Kitui Dist.
neglectus .	373	$19\frac{3}{4}$	$8\frac{1}{4}$	15	170	99	8	Nairobi.
neglectus .	313	$19\frac{5}{8}$	$7\frac{3}{4}$	15	160	82	8	Nakuru.
neglectus .	297	$18\frac{1}{2}$	$9\frac{1}{2}$	15	166	114	7	Kabete.
*neglectus** .	168	$18\frac{1}{2}$	8 M	15	168	96	8	—
neglectus .	393	$18\frac{1}{4}$	$8\frac{1}{8}$	15	168	104	8	Tumu Tumu.
neglectus .	394	18	$7\frac{1}{4}$ M	15	166	90	8	Tumu Tumu.
neglectus .	235	$17\frac{1}{4}$	9	15	168	117	8	Nairobi.
neglectus .	236	$17\frac{1}{4}$	$8\frac{7}{8}$	15	163	111	8	„
neglectus .	237	—	—	—	—	—	—	„
*neglectus** .	167	$10\frac{3}{8}$	$4\frac{1}{4}$	15	171	104	9	—
neglectus .	138	$7\frac{1}{2}$	$3\frac{1}{8}$	15	172	126	8	„
irregularis .	441	21	$12\frac{1}{8}$	15	164	142	9	Yala River.
irregularis .	432	21	$10\frac{7}{8}$	15	168	128	9	„
irregularis .	442	$20\frac{1}{4}$	$11\frac{1}{4}$	15	164	139	9	„
irregularis .	443	20	$11\frac{1}{2}$ M	15	168	112	9	„
irregularis .	444	20	$9\frac{1}{4}$	15	164	128	9	„
Philothamnus								
semivariegatus	411	$24\frac{1}{2}$	$15\frac{1}{2}$	15	117	162	9	Mombasa.
semivariegatus	329	$9\frac{5}{8}$	$4\frac{1}{8}$	15	196	132	9	Longido.
semivariegatus	381	$9\frac{1}{2}$	$5\frac{1}{2}$	15	166	151	9	Jilore.
Jacksoni .	181	$41\frac{1}{2}$	$18\frac{5}{8}$	17	179	110	8	—
Rhamnophis								
Jacksoni .	47	39	17	19	194	143	8	Kakumega.
Thrasops Rothschildi	48	$26\frac{5}{8}$	$12\frac{3}{8}$	15	163	117	8	Kakumega.
Coronella semiornata	131	$7\frac{5}{8}$	$2\frac{1}{2}$	21	182	85	8	Kismayu.
Grayia								
tholloni . .	420	$21\frac{1}{4}$	$14\frac{3}{4}$	15	142	113	8	Yala River.
tholloni . .	42	$12\frac{1}{8}$	$9\frac{5}{8}$	15	136	128	8	„
tholloni . .	422	$10\frac{1}{4}$	$6\frac{3}{4}$	15	147	122	8–9	„

COLUBRIDÆ (DASYPELTINÆ)

Dasypeltis								
*scabra** . .	171	30	$4\frac{1}{8}$	23	224	48	6–7	Kitui Dist.
scabra . .	261	26	$3\frac{5}{8}$	23	223	52	7	Kyambu.
scabra . .	316	$25\frac{1}{2}$	$3\frac{1}{2}$	23	220	54	7	Nakuru.

Dasypeltis (*cont.*)								
*scabra** . .	221	25¼	3½	23	227	51	7	Kitui Dist.
*scabra** . .	220	24	3⅜	23	224	52	6–7	Kitui Dist.
scabra . .	298	23¾	4	23	220	54	7	Kabete.
scabra . .	341	22¼	4	23	221	72	7	Jilore.
*scabra** . .	170	20¾	4¾	23	213	65	7–8	—
scabra . .	73	11	1⅜	23	223	54	7–8	Kakumega
scabra . .	262	8⅜	1⅜	23	215	55	7	Kyambu.
scabra . .	77	(Skin)						

COLUBRIDÆ (DIPSADOMORPHINÆ)

Tarbophis								
guentheri .	132	26½	6	23	229	77	10	Gobwen.
obtusus . .	133	7½	2⅛	23	224	82	9	Kismayu.
obtusus . .	133	7½	1¾	21?	226	79	10	Kismayu.
Dipsadomorphus								
blandingii .	280	62¼	16⅛	23	269	115	9	West Africa.
blandingii .	281	20	5⅜	23	265	120	9	,,
blandingii .	282	19½	5	21	274	126	9	,,
? reticulatus .	330	(head)		—	—	—	7	Longido.
Leptodira								
*hotambœia** .	172	17¾	2¾	19	166	43	8	Kitui Dist.
hotambœia .	317	16⅝	2¼M	21	175	41	8	Nakuru.
hotambœia .	412	14¼	2½	19	161	42	8–7	Mombasa.
hotambœia .	81	13¾	2⅜	19	169	47	8	Parklands.
hotambœia .	328	13	2⅛	19	171	47	8	,,
hotambœia .	80	6	⅞	19	173	45	8	,,
Hemirhagerrhis								
Kelleri . .	100	16¼	3⅝	17	188	53	8	—
*Kelleri**. .	173	12	3½	17	156	68	8	Kitui Dist.
Amplorhinus								
nototœnia .	134	13½	4⅞	17	167	86	8	Kismayu.
nototœnia .	103	5½	2	17	177	85	8	—
Rhamphiophis								
*oxyrhynchus** .	174	34	16¾	17	180	117	8	Fort Hall.
oxyrhynchus .	413	25¾	12	17	166	104	8	Mombasa.
oxyrhynchus .	405	21¼	9⅝	17	183	109	8	Voi.
oxyrhynchus .	414	17¼	8	17	170	109	8	Mombasa.
*oxyrhynchus** .	207	9⅝	4	17	178	116	8	—
Psammophis								
notostictus (skin)	178							
subtœniatus .	415	30¼	16¼	17	159	107	8	Gazi.
subtœniatus .	416	24½	12¼	17	164	106	8	Gazi.
subtœniatus .	175	20	10⅛	17	157	107	8	—
sibilans . .	226	28⅜	12	17	167	95	8	—
sibilans . .	263	27¾	12	17	175	102	8	Kyambu.
sibilans . .	264	26¼	11	17	168	101	8	Kyambu.
sibilans . .	318	25¼	12	17	180	115	8	Nakuru.
*sibilans** .	176	20⅜	10½	17	160	109	8	Kitui Dist.
*sibilans** .	224	21¼	8¾	17	167	93	8	Machakos.
sibilans . .	99	15¼	8	17	170	121	8	Taveta.
*sibilans** .	223	13	5	17	171	98	8	—
sibilans . .	338	12¼	5¾	17	161	106	8	Jilore.
*sibilans** .	222	9½	3¾	17	158	90	8	Kitui Dist.
sibilans . .	227	9⅜	3⅝	17	167	100	8	—
brevirostris .	295	30½	6	17	178	57	8	Parklands.
brevirostris .	225	23¾	5⅜	17	176	59	9	—
brevirostris .	375	22½	5⅛	17	172	60	8	Nairobi.

Psammophis (*cont.*)								
brevirostris .	98	22	$4\frac{3}{4}$	17	181	65	8	—
brevirostris .	319	22	5 M	17	168	55 M	8	Nakuru.
brevirostris .	355	$18\frac{1}{4}$	$4\frac{1}{4}$	17	170	59	8	Parklands.
brevirostris .	265	12	3	17	173	58	8	Kyambu.
brevirostris .	266	$11\frac{3}{4}$	$2\frac{1}{2}$	17	179	58	8	Kyambu.
biseriatus .	95	$21\frac{1}{2}$	$14\frac{1}{4}$	15	147	133	9	—
biseriatus .	96	21	12 M	15	151	112	9	—
*biseriatus** .	180	21	$9\frac{1}{2}$ M	15	145	85	9	—
*biseriatus** .	178	$19\frac{5}{8}$	12	15	150	118	9	Kipini.
*biseriatus** .	179	18	8 M	15	156	86	9	Taveta.
biseriatus .	249	$13\frac{3}{4}$	$8\frac{1}{2}$	15	149	126	9	Tsavo.
biseriatus .	250	$13\frac{1}{8}$	7	15	152	103	9	Tsavo.
biseriatus .	78	(skin)						
*biseriatus** .	177	(head)						
Thelotornis Kirtlandi	345	$17\frac{3}{4}$	$11\frac{1}{4}$	19	160	148	8	Jilore.
Dispholidus								
typus (*Var. F*)	52	$44\frac{1}{2}$	$14\frac{1}{4}$	19	176	104	7	Kakumega.
typus (*Var. E*)	51	$34\frac{3}{4}$	$11\frac{3}{8}$	19	179	110	7	,,
typus (*Var. D*)	50	34	11	19	178	107	7	,,
typus (*Var. C*)	49	34	$11\frac{1}{8}$	19	184	110	7	,,
typus (*Var. A*)	390	$27\frac{3}{4}$	$9\frac{3}{4}$	17	181	107	7	Fort Hall.
typus (*Var. A*)	382	$17\frac{3}{4}$	$5\frac{1}{2}$ M	19	160	78	7	Jilore.
typus (*Var. A*)	183	(head)						
Micrelaps vaillanti	101	16	1	15	226	23	7	—
Aparallactus								
Jacksoni .	244	$8\frac{3}{8}$	$1\frac{3}{4}$	15	142	41	7	Nr. Nairobi.
*concolor** .	185	$11\frac{1}{4}$	$3\frac{5}{8}$	15	226	23	7	Kitui Dist.
*concolor** .	184	$9\frac{3}{8}$	$2\frac{5}{8}$	15	153	57	7	—

COLUBRIDÆ (*ELAPINÆ*)

Elapechis								
Guentheri .	53	20	$1\frac{3}{4}$	13	163	24	7	Kakumega.
*Guentheri** .	188	$18\frac{1}{2}$	2	13	155	23	7	Nairobi.
*Guentheri** .	187	$17\frac{1}{8}$	$1\frac{3}{8}$	13	154	16	7	Nairobi.
Guentheri .	83	17	$1\frac{1}{2}$	13	156	20	7	Njoro.
*Guentheri** .	186	$15\frac{1}{2}$	$1\frac{5}{8}$	13	154	22	7	—
Guentheri .	367	$6\frac{1}{2}$	$\frac{5}{8}$	13	157	28	7	Nairobi.
Naia								
haie (head) .	331	—	—	—	—	—	—	Longido.
melanoleuca .	54	53	10	19	218	59	7	Kakumega.
melanoleuca .	55	$52\frac{1}{2}$	10	19	221	62	7	,,
melanoleuca .	56	$52\frac{1}{2}$	10	19	212	58	7	,,
melanoleuca .	57	51	10	19	212	59	8	,,
melanoleuca .	58	49	11	17	211	70	7	,,
*melanoleuca** .	189	$36\frac{5}{8}$	$6\frac{7}{8}$	19	213	60	7	—
melanoleuca .	59	23	$4\frac{1}{2}$	19	202	60	7–8	Kakumega
nigricollis .	332	$46\frac{5}{8}$	$8\frac{1}{2}$	25	192	60	7	Longido.
*nigricollis** .	193	$40\frac{1}{2}$	9	21	193	60	7	Nairobi.
nigricollis .	125	$40\frac{1}{2}$	$8\frac{7}{8}$	21	188	60	6	Nairobi.
*nigricollis** .	192	39	$7\frac{1}{2}$ M	21	199	54	6–8	Kitui Dist.
nigricollis .	137	$14\frac{1}{2}$	$3\frac{1}{8}$	21	188	57	6	Nairobi.
nigricollis .	360	$13\frac{3}{4}$	3	21	187	59	6	Nairobi.
*nigricollis** .	191	$11\frac{3}{4}$	$2\frac{3}{4}$	21	184	64	6	Elorabethuli.
nigricollis .	84	10	$2\frac{1}{8}$	21	185	58	6	Nairobi.
*nigricollis** .	190	(head)	—	—	—	—	—	—
Dendraspis								
*Jamesonii** .	195	(head)	—	—	—	—	—	Kyebe.

Dendraspis (*cont.*)								
*Jamesonii** .	194	61¾	17⅛	17	213	94	8	—
Jamesonii .	60	57⅜	18¼	19	218	107	7	Kakumega.
Jamesonii .	61	53½	15⅜	19	214	99	7	”
Jamesonii .	62	51	14⅝	19	217	98	7	”
Jamesonii .	63	49⅝	13¾ M	19	218	72	7	”
Jamesonii .	65	42	8⅛ M	19	218	70	6–7	”

VIPERIDÆ

Causus								
rhombeatus .	334	23½	2½	19	149	24	6	Parklands.
rhombeatus .	242	23⅛	2⅜	19	150	22	6	”
rhombeatus .	82	21	2½	19	150	28	6	”
rhombeatus .	378	20¾	2⅜	19	146	25	6	”
rhombeatus .	377	20¼	2¼	19	150	25	6	”
rhombeatus .	267	20¼	2¼	19	147	26	6	Kyambu.
rhombeatus .	359	19⅝	2⅛	19	151	23	6	Nairobi.
rhombeatus .	252	15¼	1¾	19	148	26	6	”
rhombeatus .	365	15	1½	19	151	22	6	”
rhombeatus .	335	11⅛	1⅛	19	149	24	6	Parklands.
rhombeatus .	337	11	1⅛	19	150	22	6	”
rhombeatus .	251	9¼	1	19	151	24	6	Nairobi.
rhombeatus .	358	—	—	—	—	—	—	Parklands.
resimus . .	383	17	1⅞	21	139	21	6	Jilore.
resimus . .	288	15	1⅜	19	134	18	6	West Africa.
resimus . .	346	14⅜	1⅜	21	143	19	7	Jilore.
Lichtensteinii .	66	24½	2	15	147	18	6	Kakumega.
Lichtensteinii .	197	11⅛	¾	15	150	18	6	—
*Vipera Hindii** .	198	10½	1¼	25	133	26	8–9	Aberdares.
Bitis								
*arietans** .	199	37½	4	31	143	27	16–17	Kitui Dist.
*arietans** .	200	33¼	2⅜	33	137	18	14	Kitui Dist.
arietans .	369	29¾	4½	32	130	31	15	Mbgathi River.
arietans .	350	29⅜	4	34	134	26	14	Thika.
arietans .	376	28¾	3¾	30	134	26	13–14	Kyambu.
arietans .	370	10	¾	32	131	19	13	Nairobi.
arietans .	323	7¾	⅝	31	130	32	14	Nakuru.
arietans .	323	7¾	⅝	31	130	32	14	Nakuru.
arietans .	324	6½	1	31	127	21	14	Nakuru.
arietans .	104	(head, brick-red var.).						
arietans .	327	(head, normal brown var.).						
arietans .	398	(38 eggs).						
gabonica .	289	31	4	35	132	33	15–14	West Africa.
nasicornis .	67	36	3	35	127	17	18	Kakumega.
nasicornis .	68	36	3	35	127	19	18	”
nasicornis .	201	29	2⅜	37	128	18	18	Yala River.
nasicornis .	69	19	1½	35	127	17	17–19	Kakumega.
nasicornis .	202	14	1⅝	36	124	26	17	Kitui Dist.
nasicornis .	70	(5 heads)		—	—	—	—	Kakumega.
nasicornis .	290	(1 head)		—	—	—	—	West Africa.
Atheris squamiger .	71	17¼	2 M	19	158	32	9	Kakumega.
Atractaspis								
irregularis .	92	20⅝	1¾	23	253	30	5	—
*rostrata** .	203	13¼	⅞ M	23	225	24	5	Kitui Dist.
microlepidota .	93	18	1¾	33	233	35	7	—
microlepidota .	72	9¾	1	33	236	35	6	Kakumega.
microlepidota .	349	9¾	¾	33	240	29	5	Serengetti.

LIFE HISTORIES OF CERTAIN EAST AFRICAN BUTTERFLIES

By Capt. P. L. Coleridge

Lycænid

The ♀ lays her eggs on a small trailing leguminous plant with hairy reddish stems and leaves and consisting of three leaflets. The flowers are light mauve and grow on a separate flower-stalk, but too distant to be called a spike.

After watching a ♀ closely for some time on September 2, 1915, I saw her oviposit on a young seed pod, which I collected about 9 A.M.

Egg.—The egg is of the usual flattened Lycænid form, and not so small as one would imagine from the diminutive size of the parent insect.

It hatched September 6, 1915.

Larva.—The infant larva does not eat the empty eggshell, but at once betakes itself to the underside of a leaf and gets in between two nervures, where it commences to feed on the cuticle. It is almost transparent, and little can be seen but a tiny, shining, black head, which is retractile.

On September 11, 1915, the larva moulted and assumed the woodlouse shape more or less. It became greener, and almost matched the midrib of a leaf (underside) in colour. When at rest the black head was completely withdrawn under segment 3. It continued to feed on the cuticle of the leaves.

On September 16, 1915, the larva again moulted, and the divisions between the segments became more marked. It refused leaves and betook itself to stems and young seed-pods. In length it was just under $\frac{1}{4}$ inch, and the retractable head's usefulness, on the end of the long neck, became apparent. It pierced the pods with great skill exactly alongside the young green seeds, which it then consumed, the larva remaining *outside* with its head *in*. In this way it emptied a pod.

On September 20, 1915, it returned to a diet of cuticle, and very occasionally attacked the edge of a leaf.

On September 22, 1915, it moulted again, and was $\frac{5}{16}$ inch long.

On September 24, 1915, it again attacked pods, and began to feed up rapidly.

It was full fed on September 28, 1915, when it was $\frac{3}{8}$ inch long. It kept its woodlouse shape and had few definite markings; the retractable head remained black and it was coloured almost exactly like the under-side of the leaf of the food-plant. It had a longitudinal darker dorsal stripe and a paler spiracular one with obscure diagonal stripes and specklings of paler green.

On September 29, 1915, it spun up in the centre of the upper-side of a leaf of the food-plant on a small bed of silk with a very short girdle. At 6 P.M. on October 1, 1915, it pupated after a larval existence of twenty-six days.

Pupa.—The pupa is $\frac{1}{4}$ inch long and devoid of any peculiar markings or tubercles. The thorax is slightly keeled dorsally, and behind it there is a slight depression. It is coloured as the larva, only the wing-cases are a slightly darker green. There is a darker dorsal stripe running along its entire length. Near the insertion of the wings there are two tiny black dots, one above the other, followed by a longitudinal supra-spiracular row of seven black specks, the first two of which are much longer than the remainder.

Imago.—The imago emerged at 9.45 A.M. on October 9, 1915, thus giving a pupal existence of about eight and a half days, and a total life cycle of thirty-eight days almost to the hour. Two days before emergence the wing-cases of the pupa became whitish and opaque, from which they passed into a faint salmon pink. They then rapidly darkened, and the colour of the imago was plainly visible the evening before emergence. The emergence itself is very rapid, and the little imago walks with considerable speed. It came to rest on a flower-head of grass with which I supplied it, and took post head downwards. In about three minutes it had pumped up its wings, which were then full-sized, and only required drying.

Hypolimnas misippus

Like all low-feeding Nymphalinas, difficult to observe.

The ♀ does not always lay her eggs on the food-plant, but walks about on the ground and lays erratically on any young low-growing herbage.

Egg.—Invariably on the under-side of a minute leaf. Dome-shaped, with twelve and fourteen ribs, coloured like a blister pearl. Hatches in two or three days.

Pupa of *Hypolimnas misippus.* It is a light ochre in colour, with darker markings in grey; the sides of the abdominal segments are pale reddish.

Larva.—First stage: Coloured like a maggot, and to the naked eye much like an infant Danaine larva. A lens at once detects many small warts on each segment, with fine hairs sprouting from them, where the processes or spines are subsequently developed.

Second and third stages: The larva becomes an oily brown and more or less tuberculous, but still has a superficial resemblance to the Danaine (Euplæidæ). Like others of this family, it grows at an astonishing pace. Feeds chiefly at night and in the evening, and, in its wild state, I believe it quits the food-plant and hides away during the day.

Fourth stage: Larva spinous and slender, but spiracular markings only faintly discernible—general colour black.

Fifth stage: As described in detail.

Pupa.—Attached by tail—hanging vertically. In form somewhat resembling Danaidæ (constricted behind thorax). Head ending in two blunt points. Thorax roughly conical

and dilated laterally. Two parallel rows of nine dorsal tubercles with a median row of seven ditto on abdominal segments. Not attached to food-plant.

Head.—Heart-shaped, orange, covered with pale warts, two long spiny processes, each ending in three or four points.

Segment 2. Two small dorsal and two lateral processes, hairy.
„ 3. Ditto (two dorsal rows, one subdorsal, two subspiracular).
„ 4. Ditto.
„ 5–11. Ditto, one medial dorsal one in addition.
„ 12–13. As 3, but no spiracular processes.

Colour velvety black, a diffuse macular tawny spiracular band; legs and claspers orange. Food-plant *Portulaca.*

Life History.—

Egg laid, March 21, 1915 Egg hatched, March 23, 1915	3 days.
1st moult, March 25, 1915, night 2nd „ March 28, 1915, morn 3rd „ March 30, 1915, night 4th „ April 1, 1915 Spun up, April 4, 1915	12 days.
Pupated, April 5, 1915 Imago emerged, April 11, 1915	6 days. ———21 days.

Parent *Dorippus* imitating ♀

I subsequently watched a *Dorippus chrysippus* imitating ♀ oviposit; she was very diligent, and walked about on the ground feeling for the food-plant with her proboscis. She invariably laid on the *right* plant.

Papilio Angolanus

Egg.—Of the usual papilionid shape, greenish white, laid on the upper surface of the leaves of young wild anana

(*A. senegalensis*), generally near the base of a fairly young leaf. Found several April 25, 1915.

One hatched April 25, 1915.

Larva.—Infant larva something like *P. Agamemnon* of India. Colour chocolate, white dorsal markings on segments 6–10. White tail points, pair of spined processes on segments 2, 4, and 5.

1st moult, April 27, 1915. The dorsal markings take on a chess-board appearance.

2nd „ April 29, 1915. The same become transverse bands, and longitudinal yellow bands appear.

3rd „ May 2, 1915. The black and white appearance of dorsum vanishes, the maroon transverse stripes appear.

4th „ May 4–5, 1915. Ditto.

Larva.—Just before final moult.

Length about 1 inch, shape as *P. Agamemnon.* Head greenish yellow, stained faint crimson. Dorsal region, a fine clear green, bounded on each side by a spiracular yellow line. A dorsal yellow line on segment $\frac{5}{11}$ inch longitudinally.

Segment 2. Usual yellow dorso-lateral processes joined by black band—margined posteriorly by a black stripe.

„ 3. Two fine maroon transverse lines.

„ 4. Two dorso-lateral blue-black spines slightly wavy, joined by two maroon transverse bands with interspace pale blue.

„ 5. Ditto

„ 6–11. Margined maroon, two maroon transverse dorsal bands enclosing blue stripe overlaying dorsal yellow line.

„ 12–13. Very slightly shaded maroon.

Tail points yellow.

Lateral and abdominal regions greenish stained crimson $\frac{3}{6}$ inch.

Legs and claspers green, latter slightly hairy.

Larva.—Full fed, very like *Agamemnon.* L. nearly

2 inches. Head green, legs and claspers green, latter rather hairy. Generally, uniform clear grass green. A supraspiracular longitudinal pale yellow band connects the processes on 2 with the tail points. On this on each segment two brighter chrome spots. 2. Margined fore and aft with black narrowly. Processes yellow tipped with black. 4 and 5 each with two simple blue-black dorso-lateral spines sprouting from orange tubercles. Tail points yellow. Ostmateria green. Before pupation the larva shrinks considerably (to about 1 inch in length) and becomes a very pale clear green. Pupation effected in three minutes.

Pupa.—The resemblance to *P. Agamemnon* continued. Attached by tail and short body, strung to a stem of the food-plant under a leaf.

The head ends in two points, fairly sharp. The thorax is keeled and produced forward into a fairly long horn. Otherwise the pupa tapers gradually and evenly to the sharp anal point. In colour it imitates the leaf of the food-plant, every segment being regularly veined. A pale green spiracular stripe from tip of horn to tail. Two longitudinal subdorsal slightly divergent stripes of a similar colour from base of horn to tail, where they unite. Pupal period, eleven to twelve days.

SUNDOGS AND HALOS SEEN AT NJORO NOVEMBER 5, 1909

By W. A. Tunstall

The rainbows to the N. and S. of the sun appear to vary, at times appearing to be concentric with the sun, at others to have their centres N.E. and S.E. on or about the horizon.

Maximum brilliance of phenomenon about 9.15 or 9.30 A.M., Figs. 4 and 5, when red (bronze) part of spectrum of figures surrounding the sun very pronounced.

10 A.M.—Fig. 6. Surrounding circle and ellipse nearly

coalesced. Light ellipse with sun on edge very faint. All phenomena much contracted.

Sundogs, November 5, 1909; *Njoro,* 5.45 A.M.

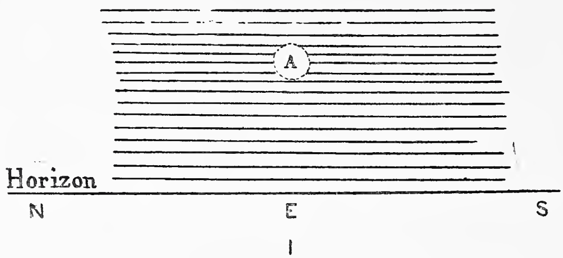


FIG.—1. Sun below the horizon.
Brilliant indefinite concentration of light 'A' in clouds above position of sun.

10.15 A.M.—Surrounding circle and ellipse seen to have coalesced with red edge towards the sun. Fig. 6. Bright in-

Sundogs, November 5, 1909; *Njoro,* 6.15 A.M.

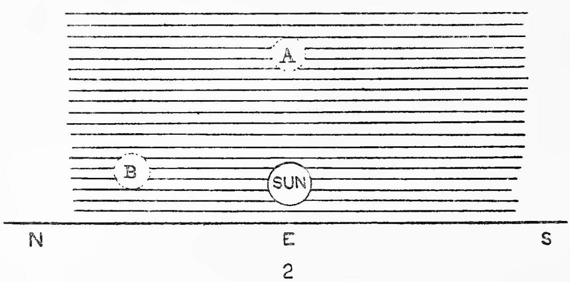


FIG. 2.—Brilliant indefinite concentrations 'A' and 'B' of light in clouds above and to the north of sun. (None on the south of the sun.)

definite band outside. All phenomena have red portion of spectrum towards the sun.

Upper light ellipse of Fig. 5 almost disappeared. Time given taking sunrise as 6 A.M.

Sundogs, November 5, 1909; Njoro, 8.45 A.M.

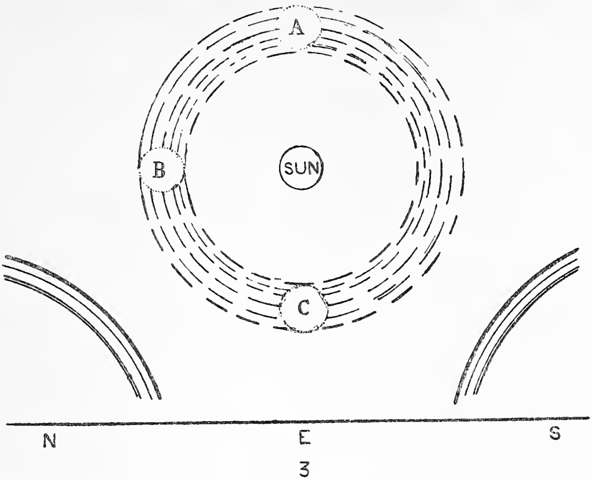


FIG. 3.—Bright circle round the sun. Very definite above, less definite to the north, and invisible to the south. Concentrated under the sun into a very brilliant patch of light (C). To north and south dull but very definite segments of rainbows (?), the red portion towards the sun.

Sundogs, November 5, 1909; Njoro, 9 A.M.

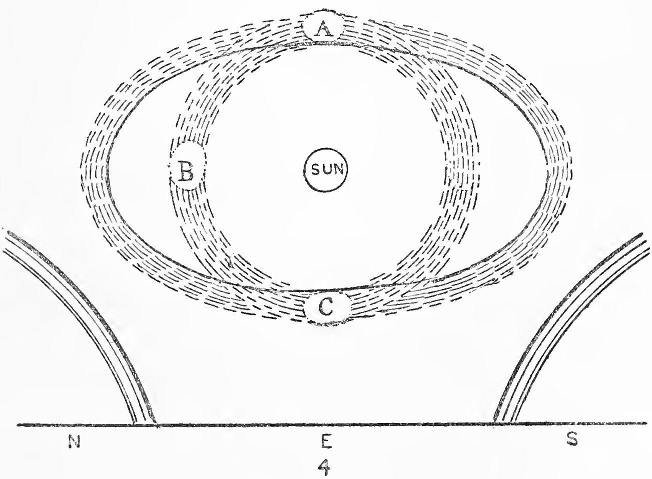


FIG. 4.—Faint rainbows to N. and S. much larger than at 8.45. Large bright ellipse developed, surrounding the circle round the sun. Concentrated patches A and C edged with faint spectrum colours on sides next the sun. Practically no clouds, but a great deal of vapour (?) in suspension.

During the phenomena there has been a haze in the upper strata of air which does not appear to be suspended moisture.

There appear to be three strata of air. The surface S.I.E., an upper one E. or W., and a higher one S.E. or N.W.

Sundogs, November 5, 1909; *Njoro*, 9.45 A.M.

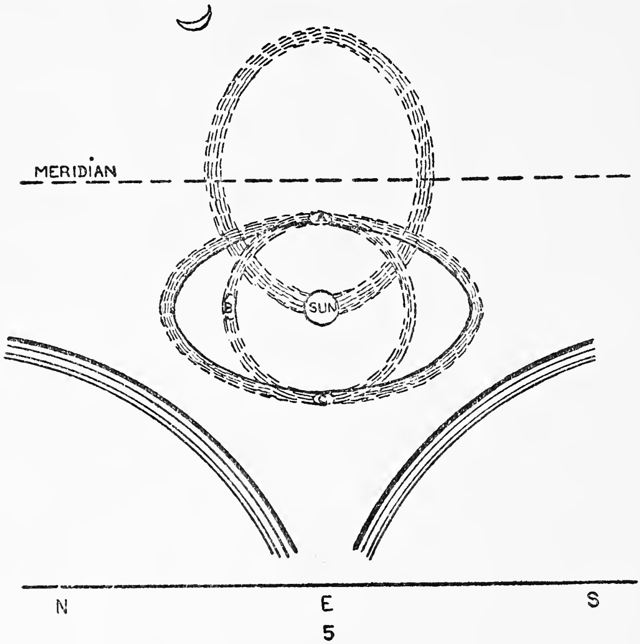


Fig. 5.—New large white ellipse developed about this time, with sun on periphery and intersecting original circle and ellipse. New ellipse extends well above meridian. Lowest points of N. and S. rainbows no longer touch horizon. Moon in last quarter.

Clouds.—E. cumulo-stratus; W. cumulus; zenith, very small cirro-cumulus.

10.45 A.M.—White upper ellipse of Fig. 5 still traceable, but very faint.

10.45 A.M.—Large ellipse of Fig. 6 has developed purple end of spectrum.

10.55 A.M.—Upper ellipse of Fig. 5 disappeared. Inner circle and concentric ellipse no longer separate.

11 A.M.—Surrounding circle (ABC) getting indistinct.

11.10 A.M.—Surrounding circle very brilliant again, and large arc of Fig. 6 much reduced in size and brilliance.

Sundogs, November 5, 1909; *Njoro,* 10 A.M.

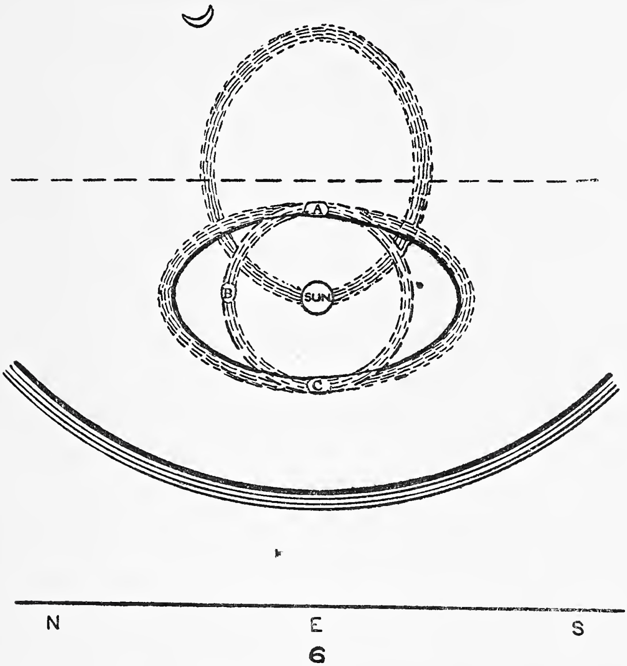


FIG. 6.—N. and S. rainbows joined permanently at lower ends and form large ellipse outside main phenomenon.
Rainbow ellipse about ⅓ periphery.

Am almost convinced that phenomenon is *not* due to moisture, as there is at present little haze in the sky in the region of the sun, and the brilliance does not seem to be affected by the amount of haze.

11.30 A.M.—Fig. 7. Large outer arc of Fig. 6 disappeared. Surrounding circle very bright. Bright haze concentrated round the sun.

11.45 A.M.—Phenomenon disappearing.

12.30 A.M.—Phenomenon almost disappeared.

1 P.M.—Very bright haze on horizon on due *West,* otherwise phenomenon entirely dispersed.

Sunday, November 7.—Indications of Fig. 1 at sunrise, and

Sundogs, November 5, 1909; *Njoro,* 11.30 A.M.

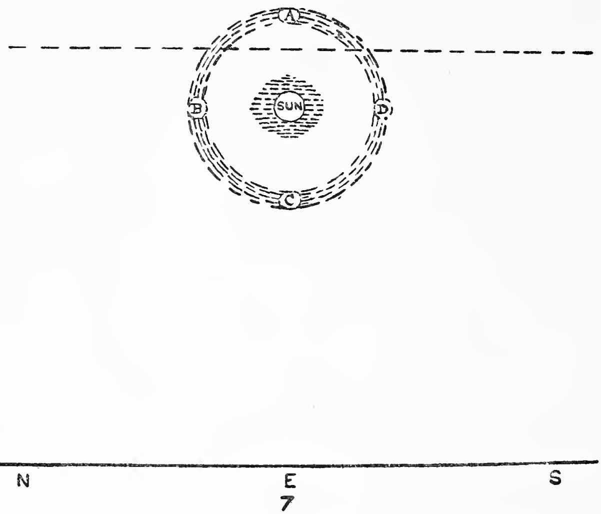


FIG. 7.—Other phenomena dispersed. A bright haze round the sun. Original halo only remaining.

Width of original halo exaggerated to give more prominence to bright mock suns (A, B, C and D).

indications of circle round the sun later. Peculiar horse-tail clouds very filmy, converging due W.

January 3, 1914.—Have seen pre-sunrise phenomenon once or twice since, but nothing approaching the above in interest.

In the above phenomenon the spectrum colours, although pronounced, were dull, the red being more of a brown, and the blue indistinguishable from and fading into the blue of the sky behind.

DESICCATION OF EAST AFRICA

By Captain Henry Darley

With reference to Mr. C. W. Hobley's article on alleged desiccation of East Africa in the *Geographical Journal* of November 1914, I am venturing to submit the following remarks.

South of the railway, or shall we say of the Equator, I know nothing, but north of that line I know it better than anybody, black or white, as far as the Addis Abeba and Khartoum line.

Take the Mount Kenia as one end of this line and Mount Elgon as the other. The intervening portion is crossed from north to south by the Rift Valley, with its accompanying volcanic disturbances, and the country generally falls away towards the north.

North of the line from Kenia to Elgon I believe the country is rapidly desiccating. That is to say, it is desiccating as far as Abyssinia. Abyssinia must be left out of the question as it is part of original Africa. It has never been subject to volcanic eruption, but north of that the desiccation again commences. This subject—that is to say, the subject of the country north of Abyssinia—is, however, so large that it is very difficult for one man to propound a satisfactory solution of the problem.

With reference to the part north of Abyssinia, it is well to remember that when the Jews fled from Pharaoh large numbers of them were cut off, owing to the cessation of the north wind. This north wind, as now, used to drive the waters back from the Bitter Lakes.

The hosts of Pharaoh were probably engulfed by the rise of the water, but a large number of the Jews who were following the main party appear to have been cut off, and to have travelled down the west side of the sea until they reached Abyssinia.

The track by which the main body of the Jews fled eastward is still a well-known caravan road, and can clearly be seen from the deck of any Nile steamer.

It is also interesting to notice that at this time the Red Sea was called the Sea of Reeds, and I believe that a certain amount of fresh water is necessary for the propagation of this plant. Certainly the reeds have ceased to exist.

This tends to show that at that time the shores of the Red Sea were therefore much better watered than they are at present.

Not only that, but the high-water level of the Nile was over thirty feet higher than it is at present.

Now if one proceeds southward up the Nile above Khartoum, evidences can be seen which point to the extent of the Sudd being at least twice what it is at present.

If you dig anywhere between the White Nile and the Abyssinian plateau, you will dig 120 feet through white sand, and not find a stone the size of your finger-nail in it. On the top of this sand occurs a layer of about six feet of black mud. It is considered that this mud marks the area originally covered by the Sudd.

At many places at the foot of the Western Abyssinian escarpment there is a regular formation which reminds one of an ancient beach. Numerous streams run down from the hills of Western Abyssinia, and when they reach the alluvial plain sink in and disappear. A large amount of water is thus continually lost, and must flow away towards the Nile. Some authorities are of opinion that there is a vast amount of water stored in the sands in the Nile valley and its vicinity, but at a lower level than the river bed and unaffected by the rise and fall of the Nile and its tributaries.

To go back to the country farther south, but north of the Kenia-Elgon line, any old native will here point out places where in their boyhood they used to water their cattle. Large stretches of this country are now *bondis* or dry watercourses.

The history of the Euaso Nyiro, which now virtually ceases in the Lorian, is too well known to all to note beyond the fact that it used originally to run from there into the sea.

North of that comes a stretch of country called Ingaroni, or the waterless district.

This district ceases at Essery, where again the water of the Sayer sinks into the ground.

It is evident that east of the Lorian and Essery line there has been a sinking of ground at some not very ancient times. The fact remains that in times of rain the waters from Essery and the Lorian go much farther than in the dry season.

In a few places which have not sunk, the water reaches the surface. North of the Sayer-Essery line is an absolutely waterless district, with the exception of the Mathews range, which is practically waterless, and a few mountains, all of which are volcanic, such as Marsabit and Kulal, where a little water is still found in pockets and small springs north of the Kulal-Marsabit line.

There is no water right up to the foot of the Abyssinian Hills.

Try back now to the district south of Lake Rudolf.

This also has sunk, and the Toron river runs through miles and miles of salt beds which were originally a lake area.

The marks of the volcanic action on the hills each side of this river are really remarkable, and more like pictures of Dante's Inferno than I conceived imaginable.

This is Turkana land, and it is one of the most difficult countries to traverse if you do not stick to the Kerio and Turkwell rivers. The country west of Lake Rudolf, which has dried up earlier, is even more difficult.

In this latter country, the country falls in a series of steps, and the subsided water-courses are even worse defined than they are east of Lake Rudolf. Beginning at Mount Elgon, the water rising in this extinct volcano does not run north.

The last example of volcanic activity north of lat. 4° is the extinct volcano of Kisgangor, west of the Boma Plateau on the Kuron river.

There is a stretch of country as far as Marangule which, being only a partial subsidence, is higher than the rest, and has formed itself into the watershed between Rudolf and the Nile. There are here a few—a very few—streams where water may be obtained by digging, but even at such places the natives—for instance, those at Mamimani and Tiwe—will show you stretches of country several days in extent where they used formerly to graze and herd their flocks and herds. This is now dried up.

Leaving Marangule this subsidence is even more determined.

You can sit on the Marangule slopes and see almost to Abyssinia, a distance of fifteen to twenty days' march. This is absolutely waterless, with the exception of a few places in ancient *bondis*, where by digging you may obtain water.

Within the last thirty years this was thickly inhabited.

These inhabitants have now fled to the country sloping to the Nile where water is still obtainable.

East of Mogila and Zingole there is no water. Lake Rudolf is also rapidly drying up.

I have only touched the question as a whole, but information from men in other parts will, I am sure, tell the same story.

LIST OF DONORS OF SPECIMENS TO THE SOCIETY'S COLLECTION. January to December

Agnew, Mrs. . .	Five moths and one larva.
Banks, Rev. R. . .	Two praying mantis.
Barnes, A. C. .	Four moths and two beetles.
Beaton, Master Kenneth	Serval cat (*Felis serval*).
Binks, H. K. . .	Smooth-clawed toad (*Xenopus laevis*).
Binns, Rev. H. K. .	Scorpion, two beetles, and a mantis (*Harpactes ocellatus*).
Birkett, Dr. . . .	Two black-necked cobras (*Naia nigricollis*).
	A night adder (*Causus rhombeatus*).
Black, M. A. . .	Four naked sand rats.
	One skull of rodent.
	Ten snakes.
	Six lizards.
	One frog (*Phrynomantis bifasciata*).
	Sixty-three fish.
	Two scorpions.
	One caterpillar.

Black, M. A. (*cont.*) .	Two holothurians.
	One starfish.
	Several marine worms.
Blunt, Mrs. . . .	Praying mantis (*Harpactes ocellatus*).
Burmeister, Lieut. F. L.	Native skull.
	Skull of rock hyrax (*Procavia maculata*).
	Hinged tortoise (*Cinnixys belliana*).
	Praying mantis.
	Mosquito.
	Two spiders (*Casteracantha*).
	Nine shells (*Achatina and Limicolaria*).
Burns, Master Norman .	Two moths and two beetles.
Bush, A. G. . . .	Immature cobra (*Naia nigricollis*).
	Membraneous insect (*Centrotus sp.*).
Butcher, Sergt.-Major .	Two snakes (*Psammophis biseriatus*).
Bux, Maula . . .	Skull of manatee (*Halicore dugong*).
	Sail and sword of shark (*Istiophorus* (*nigricans* ?).
Carnegie, Hon. Major	Desert buzzard (*Buteo desertorum*).
Chart, Master . .	Sand snake (*Psammophis brevirostris*).
	Night adder (*Causus rhombeatus*).
	Frog (*Phrynobatrachus acridoides*).
Cherrett, Dr. . .	Mole rat.
Cook, J. P. . . .	Skin of squirrel (*Paraxerus jacksoni capitis*).
	Skin of mongoose (*Herpestes albicauda* ?).
	Three young mice.
	Fourteen snakes.
	Three skinks.
Cundel, J. . . .	Swallowtail butterfly (*Papilio demodocus*).
Creighton, J. K. . .	Red-lipped snake (*Leptodira hotamboeia*).

Creighton, J. K. (*cont.*) .	Night adder (*Causus rhombeatus*).
Curnow, S. J. D. . .	East African green snake (*C. neglectus*).
	Night adder and fourteen eggs of same.
	Two moths.
	Diatomite.
Dawson . . .	Two moths.
Eardley . . .	A squirrel.
Ellson	Chameleon (*Chamaeleon Jacksoni*).
	Five rose beetles.
Fox, Master Jack . .	Trap-door spider.
Fuller, Master Lewis .	Trap-door spider.
Hairer	Two green snakes (*Chlorophis neglectus*).
	Square-marked toad (*Bufo regularis*).
Higgins, E. Scott . .	Twenty butterflies.
Hinde, S. L. . .	Chameleon (*Chamaeleon Jacksoni*).
	Forty-six moths, mostly Sphinges.
Hobley, Hon. C. W. .	Two free-tailed bats (*Nyctinomus Hindei* ?)
	Blind snake (*Glauconia nigricans*).
	Puff adder (*Bitis arietans*).
	Twenty-two specimens of marine fish.
	Octopus (*Polypus horsti*).
	Aquatic bug (*Bellostomatidae*).
Holmes, Reginald . .	Skull and scalp of waterbuck (*Cobus defassa*).
	Seventeen snakes.
	Four lizards (*Chamaesaura tenuior*).
Johnson, J. W. . .	Monkey (*Cercopithecus kolbi nubilus*).
	Mongoose (*Herpestes albicauda*).
	Three birds, including 'Blue Jay.'
	Hissing sand-snake and slough.
	Four insects.
	Two spiders.

Jolley, Cyril . .	Augur buzzard (*Buteo augur*). Twenty-two bird's eggs. Green snake (*Chlorophis neglectus*). Butterfly (*Catopsilla florella*).
Jolley, R. N. . .	A bat. Brown house snake (*Boodon lineatus*). Three green snakes (*Chlorophis neglectus*). Sand snake (*Psammophis brevirostris*). Oleander moth (*Chaerocampa nerii*). Two dor-beetles.
Jolly, G. G. . . .	Colubrine snake (*Philothamnus semivariegatus*). Head of tree snake (*Dipsadomorphus sp.*). Head of Egyptian cobra (*Naia haie*). Salmon-coloured *Naia nigricollis*.
Jones, Capt. . .	Mantis (*Gongylus sp.*).
Jones, Master Alfred .	Large spider.
Jordan . . .	Twenty-four West African snakes. Burrowing amphibian (*Geotrypetes sp.*). Seven scorpions (*Pandinus sp.* ?). Praying mantis voiding hair-worm. Chafer beetle.
Kell	Burrowing snake (*Typhlops punctatus*). Black-headed snake (*Aparallactus Jacksoni*). Night adder (*Causus rhombeatus*).
Knight, C. D. . .	Scarab beetle.
Knight, W. G. D. .	Chameleon (*Chamaeleon Jacksoni*). Eight insects.
Leakey, Miss Gladys	Four birds.

Leakey, Rev. H. . .	Skull of *Colobus abyssinicus caudatus*.
Leakey, Master Lewis .	Horseshoe bat (*Rhinolophus Hildebrandti*).
	Porcupine (*Hystrix galeata*).
	Twenty-nine birds.
	Four francolin eggs.
	Four snakes.
Lewis, Mrs. . . .	Three insects.
Martin, J. . . .	Nest and six eggs of a weaver bird.
	Two moths.
Matthews . . .	Seven moths.
	One katydid.
McMillan, Capt. W. N. .	Tree mouse (*Dendromys insignis*).
	Garter snake (*Elapechis Guentheri*).
	Night adder (*Causus rhombeatus*).
	Frog (*Rana sp.*).
Meinerthagen, Major .	Skull of *Oryx callotis*.
	Forty-eight birds, mostly British migrants.
Munro, Master C. . .	Horseshoe bat (*Rhinolophus sp.*).
Nair, Asst. Surg. . .	Thirteen snakes.
	Nine lizards.
	Two frogs.
	Number of freshwater crabs.
Oxley, F. . . .	Night adder (*Causus rhombeatus*).
	Thirty-two insects.
Panting, C. C. . .	Red-lipped snake (*Leptodira hotamboeia*).
	Night adder (*Causus rhombeatus*).
	Large mygale spider.
	Rhinoceros beetle (*Oryctes nasicornis*).
Parry, Robert . .	Two Chameleons (*C. Jacksoni*).
	Seventeen insects.
Percival, Capt. Blayney	Hawksbill turtle (*Chelone imbricata*).

Percival, W. G. . .	Three birds.
	Brown house snake (*Boodon lineatus*).
Pickwell, E. H. . .	Puff adder (*Bitis arietans*).
Pirrie, Mrs. M. H. .	Number of caterpillars.
Rainsford, R. E. . .	Dorsal bony plates of Trionyx.
	Four rock specimens.
Ross, W. McGregor .	Two snakes (*Boodon lineatus*).
Sergeant, Mrs. J. . .	Four green snakes (*Chlorophis neglectus*).
Shircore, Dr. . .	Collection of 200 moths.
Skene, R. . . .	Skull of dugong (*Halicore dugong*).
Southon, C. E. . .	Puff adder (*Bitis arietans*).
Starey, E. J. . .	Hemipterous larva.
Tarlton, Lieut. L. J. .	Fourteen birds.
	Cape wolf snake (*Lycophidium capense*).
	Chameleon (*Chamaeleon Jacksoni*).
Thomas, Mrs. . .	Four chameleons (*Chamaeleon Jacksoni*).
Thomas, Misses M. and D.	Hard-head beetle (*Copris iscis*).
	Two caterpillars of silkmoth.
Thompson, Dr. J. H. .	Garter snake (*Elapechis Guentheri*).
	A round worm.
	Caterpillar.
Tunstall, Master Alfred .	Brown house snake (*Boodon lineatus*).
	Stick insect.
Turner, H. J. A. . .	A galago.
	Two bats.
	Eight birds.
	One chameleon.
	One burrowing viper (*A. microlepidota*).
	Two agama lizards.
Van Someren, Dr. V. L.	A rat (*Otomys canescens*).
	Three birds.
	Seven snakes.
Walker, A. . .	Lilac-breasted roller (*C. caudatus*).

Williams, J. H. . .	Six snakes' eggs.
Wilson, W. Maclellan .	Augur Buzzard (*Buteo augur*).
	Brown house snake (*B. lineatus*).
	Hair worm (*Gordius sp.*).
Young, J. M. . .	Palystes spider.

We are not printing a list of printed matter received, but take this opportunity of thanking those institutions and authors of papers who continue to send us their publications. At some future date it will be advisable to print a list of the works in the Museum Library.

The following specimens on Loan have been received during the year:

Harrison, A. E. . .	Nineteen early stone implements discovered in B.E.A.
Hinde, S. L. . .	A zinc and glass aquarium.
Turner, H. J. A. . .	A number of bird and mammal skins.

NOTES

NATURAL HISTORY NOTES FROM BRITISH EAST AFRICA

By A. Loveridge

January 4, 1915.—The journey up from Mombasa was hardly as interesting as I had anticipated. The scenery was delightful, first tropical, then scrub, and finally the great bare plains whose ugliness was only relieved by the game. Being the hottest part of the year, most of the herds had migrated to the foothills, the grass on the plains being scorched up, and I did not see more than five hundred head. These were composed of wildebeest, Coke's hartebeest, Grant's gazelle, Thomson's gazelle, some fleeing buck, ostriches, secretary birds, Marabou storks, and a vulture.

At Machakos Road Station we had a shower which brought a toad out from its hiding-place, and I climbed through the carriage window and pursued it on the offside, but ineffectually. It hopped away in bounds creditable to an English frog, revealing a scarlet abdomen in so doing. I thought no true toads could leap. Took a striped hawk moth, cockroach, oil beetle, &c., at the light in the railway carriage.

January 13, 1915.—I have most comfortable and delightful quarters at Nairobi in a bungalow some three miles from the Museum. My predecessor, sleeping in the same room last year, had a wild cat, probably a serval, jump in right on to his bed, which was beside the window that opens on to a verandah. A neighbour on rising from dinner had left a roast joint on the table, the window being open. The boy, coming to clear away, surprised a serval lunching off it on the sofa, where it had dragged the heavy joint from the table, leaving a greasy trail across the carpet. The cat, holding its capture, went straight through the window.

I rose at daylight, about 5.30, and crossed the road to the Forest Reserve, some four hundred yards from the house. I had not penetrated very far into it when I heard the baboons crashing about in the trees. They make a tremendous row, and also utter a deep bass noise, half-bark, half-growl, which has, I believe, been likened to 'chacma.' Altogether I saw some thirty of these beasts in an hour. If I remained still they would come close (fifty yards) and look down at me from their leafy retreats, but as soon as one moves, away they go, crashing and setting all the branches swaying. They are rather awe-inspiring beasts, nearly as big as a mastiff in some cases. With them was a Cercopithecus monkey with a broad white collar—I believe it is Syke's monkey. There was another monkey of a smaller species in the trees.

Came up under a tree in which there was a brown owl, probably the long-eared (*Asio otis*) which is found here. You will be interested in hearing that the English barn owl is also found here. Blundered badly in poking an apparently old nest out of a tree on the chance of finding vermin in it—a fresh egg, apparently a shrike's, fell to the ground and broke.

There are a lot of desert buzzards (*Buteo desertorum*)

about, fine brown birds, very like the English so-called common buzzard. Doubtless in time all the fine hawks, which one sees daily, and the eagles, which may be seen weekly, will become as rare here as in England with the advance of civilisation. On a carcase of one of these desert buzzards were numbers of very common beetles called *Dermestes vulpinus*. Dorsally these are not unlike the English *Dermestes*, but when I bent over the body, hey presto, with one accord they all rolled over on their backs, with legs drawn up, and then, to all intents and purposes, they were 'bird-droppings,' the lower surface being blotched with white.

January 15, 1915.—Toiled in the heat of the day 2 till 5 P.M. and caught nothing. I mention this so that you shall not run away with the impression that Africa is teeming with insect life at all seasons. This is toward the close of a six months' dry season, and as the rains failed to a great extent last year everything is burned up. At 5.30 I went out again and found a human skull and a sweet little nest suspended in some low scrub. A freshly-killed newly-born black-necked cobra was sent in to the Museum to-day. I found one on the 11th inst., about the same length; it was lying dead in the road, having been killed.

February 20, 1915.—Cycled out to Kabete and spent the week-end at the C.M.S. Mission. The children of the missionary had a number of animals in captivity, amongst these being a colobus monkey which had only been caught six weeks before, and yet would feed from the hand. Young colobuses have a little thumb which disappears with advancing years, till in hoary old sinners like this specimen there is scarcely any trace of such a thing. With their long black-and-white fur, one would think them the most conspicuous of creatures, but I notice Gregory in his 'Great Rift Valley' says that this is far from being the case as in the Kenia forests they appear like one of the great tufts of lichen (*Usnea*) with which most of the trees are draped.

A specimen of the East African Genet (*Gennetta bettoni*) was another interesting captive that had been caught in the garden in a simple but ingenious trap made of a Tate's sugar-box. In this they had also caught a black-backed jackal

Canis mesomelas) and two white-tailed mongoose (*Herpesse albicauda*). It was a great pleasure to me to meet children who were all so keen on natural history, and they are in a country with no natural history books to tell them of all the new creatures that are to be met with. The Germans have long ago brought out books on the fauna of G.E.A. When shall we do likewise?

Two duikers which had been brought up by hand by the children were as tame as cats, and were kept in the spacious fowl-run. They were so absolutely fearless that they came and rubbed up against me when I entered; they slept at night in the fowl-house. On one occasion when they had been neglected and left unfed, these little antelopes, no larger than lambs, each killed a fowl, and were found eating same. I recollect reading in the *P.Z.S.* about 1905 or 1906 an account by Mrs. Hinde of Kenia of some antelopes which they kept. These beasts were found to be constantly killing fowls and lapping their blood until they were provided with a salt-lick. Now how did the beasts know that they would find salt in the blood of fowls?

In the garden were a number of chameleons, of which I saw at least seven; these the children handled freely; rushing into the garden when flies were superfluous at table and returning with one or two, which were replaced on the bushes when their services could be dispensed with. They failed to reduce the numbers of flies to any appreciable extent. Down in the stream I caught a dozen smooth-clawed frogs (*Xenopus lævis*), taking six with one sweep of the net and four with another. I also took several frogs, one of which had retained its tail, though apparently full grown. The water-scorpions (*Nepa*) were as large as typical scorpions—that is, about three inches long; water-beetles were very numerous. Saw several striped skinks (*Mabuia varia*).

One weaver bird's nest contained an egg, white ground colour with red spots; on the 22nd there was a second added. A dove had also one egg, and I found an addled egg in the nest of one of the tiny waxbills, which are scarcely larger than a man's thumb. There is no particular nesting season here; you may find eggs at any time. This is not a boon

to the ornithologist, as at first might be supposed, as you are forever climbing up to empty nests or ones that are inhabited by ants, which is a great deal worse. Honey-suckers were hovering over the sisal poles, removing the nectar till the last glimpse of daylight.

About a heap of stable rubbish, hay, and manure, hundreds of blue hornets (*Scolia ruficornis*) with red antennæ were flying with ceaseless activity, and, as far as I could find out, without any object. Occasionally one would rest on a heap or on the grass and clean its antennæ and then resume the giddy whirl. Under the verandah roof two species of long-waisted black and yellow wasps were building their paper nests. The larger was *Sceliphron spirifex* and the smaller *S. quarantine*.

February 27, 1915.—Cycled out to Kyambu, about ten miles; roads awful, dust three inches deep; frequently deeper holes with big stones in them hidden by the dust. This is all due to the heavy bullock-wagons and the sharp hooves of the animals, which may be seen cutting up the road. Saw a duiker, an eagle, and several large hawks, one of which I believe was the African peregrine. Also saw two brilliant bee-eaters and a roller. Only two of the many weaver birds' nests examined contained eggs. Apparently both were those of the golden-faced weaver (*Ploceus xanthops*); the one, however, was pale blue, and the other pale blue with red spots. There were two eggs of the latter. One nest contained young, and another which had been blown down held dead young ones.

In climbing a tree to recover a Peter's glossy starling (*Lamprocolius sycobius*) which my companion had shot, I was fiercely attacked by ants, which got inside my shirt and gave me as bad a time as wasps would in England, only that the pain went off soon. They seemed to make a special set for my arm-pits. The labourers had killed two snakes, a *Boodon* and a *Psammophis*, both badly smashed.

March 13, 1915.—Went out on the plains, where I found the skulls of a mule, zebra (*Equus burchelli Granti*), and hartebeest (*Bubalis Cokei*), besides many others not worth the taking. Caught two voles in nest, also a skink (*Mabuia varia*).

Saw a golden-backed woodpecker (*Mesopicus rhodeogaster*), a black rail (*Ortygometra niger*), and augur buzzard (*Buteo augur*), a magnificent species.

March 19, 1915.—Caught six more skinks (*Mabuia varia*) on hillside by P.W.D. sheds ; also took three very hairy caterpillars and one that had spun up from under a stone. The hair was so long that I at first mistook them for a rat curled up in its hole.

March 20, 1915.—At same spot as yesterday caught three more of the lizards. Down by a donga (dry watercourse) a $17\frac{5}{8}$ inch black-necked cobra (*Naia nigricollis*) started from a tussock of grass as I passed. My boy, who was two yards behind, struck at it with his cane. I heard the thwack and was back with a bound. The reptile sat up, faced me, and spread its hood, when I pinned it down and picked it up ; by the time it was in the bag I expect it was nearly dead. We also caught some specimens of *Rana Nutti* (Nutt's frog) in a pond.

March 22, 1915.—At a pond in Parkland's Forest I took thirty-nine specimens of the smooth-clawed frog (*X. lævis*) and five *Rana*. This will give you some idea of the way this pond was teeming with the creatures ; it was nothing uncommon to take five or six each time with a judicious drag of the net along the bottom.

March 24, 1915.—At a pond on the plains I found *Xenopus* abundant, took seven specimens of *Rana Nutti*, two of *Rana* sp. ind., and one of lots of *Dytiscus* beetles, and one huge *Hydrophilus* were caught. Someone brought in two fine Jackson's chameleons (*C. Jacksoni*) from the road outside, and I caught one in the garden myself.

March 29, 1915.—First heavy rains last night, 1·85 inches. I looked out at 7 A.M., when it was still raining, and the sky was full of flying termites, about one to every ten cubic feet and as high up as could be seen. I went out and caught a dozen ; they were numerous in the grass, where they perched head downwards and flapped their wings very fast. These wings are so fragile that it is a wonder that they stand wet at all. A pool was formed in a depression about a hundred feet from my window, 15 feet long by 5 feet wide by 8 inches

deep in the middle. At dusk such a chorus began as I never heard before.

Taking my net, I went across in the moonlight, and found the artistes to be the square-marked toad (*Bufo regularis*), with *Rana Nutti* and *Rana oxyrhynchus* for accompanists. The former was deep bass, and the sound was like that of a person snoring in the roof of their mouth with the latter open. This does not give an exact impression, as the sound is continued like a saw for a long spell. The frogs may best be represented by an attempt to whistle the word 'wait' whilst drawing your breath in. When a number of frogs do this together it sounds as if there were a warble or trill, but this impression is only produced by numbers.

I dissected the stomach of one of the toads, and found it distended with termites; there was only one other insect present, and that a beetle. The wings and bodies of the termites were all compressed into one mass. On April 2 we had a terrific thunderstorm and deluges of rain, but the amphibians were not in the least nonplussed, but kept going strong, only stopping occasionally when a particularly vivid flash of lightning lit up the whole countryside.

March 31, 1915.—At the Museum I have half a dozen live three-horned chameleons (*C. Jacksoni*), and these are confined to branches of eucalyptus which are tied to the cords of the electric light lamps.

Whilst sitting at the table writing, I heard the sound of a moth flapping its wings, and glancing round saw a large yellow underwing (not English species, twice as large) in one of the eucalyptus branches. Seizing a killing bottle, I hurried across the room, supposing it to have got caught in some spider's web, but on reaching the spot found one of the chameleons had caught it by the right hind wing; the moth, being large and strong, flapped vigorously, but the chameleon bided its time, and when the struggles had subsided somewhat took a few gulps, and soon had the body of the moth almost entirely hidden from view in its mouth.

Meanwhile the second chameleon on that branch had been eyeing its companion with evil in its heart. As soon as it perceived that the captor was in difficulties, it hurried across

the intervening twigs and, pausing only to take aim, shot out its tongue and caught one of the feebly flapping free wings; having got this into its mouth, it commenced a tug-of-war jowl to jowl, and succeeded in wrenching the whole moth from its companion's jaws. The poor moth's fur was flying in the air, and the first chameleon's mouth was woolly with it—that was all the share of the spoils that he was destined to receive.

The way these chameleons fight is shocking. I have three electric light cords with branches tied to them at a height of five feet from the ground; each has two chameleons in residence. More than two are not tolerated; introduce a third, and the two original inhabitants hurry towards it open-mouthed, and go faster than I have ever seen chameleons go before. As a preliminary, when face to face they generally sway their bodies from side to side, and if the intruder does not at this juncture turn tail and cast himself off to the ground, as is generally the case, the attack commences. One chameleon I had was very ingenious: he placed his head on the branch, which, of course, was vertical, and his one rostral and two occipital or supra-ocular horns would be pointing downwards, and then he advanced on the foe and with these fixed bayonets would sweep him off; sometimes the foe would grasp one of the horns in its hand and a tussle begin.

They then bite each other hard, and I have even seen the one mount the other's back, and, digging its claws in, continue the attack, holding on so hard that I had the greatest difficulty in disengaging its grip. Several times I have seen one grasp the other's arm in most human fashion and then butt it with its armoured head. I was very interested in this, for hitherto I had considered these horns as merely extravagant growths, as in many species of beetles.

One chameleon in throwing himself off the branch was injured and lay on its side, the hind limbs and tail being paralysed. When put on the branch, it dragged them after it very helplessly, and in one minute the tail and hind limbs and posterior half of the body were almost white, the rest of the body being dark green verging on black. As it did not recover in three minutes, I anæsthetised it.

April 1, 1915.—Another of the chameleons fell or threw itself down and killed itself ; the posterior half of the body went white immediately, and the poor creature never stirred again. Sometimes one will jump down six or more times in a single morning, and these two accidents must be due to their having fallen on their backs. When given a grasshopper the other day, it held the kicking fore-legs in its hand ; another that I had I gave five ant-lions, about four inches long, one after another, and with its hand it pulled off the wings before eating, in the most human fashion.

April 3, 1915.—On the hillside by the P.W.D. workshops I caught thirteen lizards of five different species: a gecko under a stone, an agama under the roots of a tree, which subsequently proved to be a female with ten eggs in the oviduct ; nine striped skinks basking or under rubbish, and a very snake-like skink with highly polished scales in a termites' nest under a huge stone. There were a number of very large *Polydesmus millipedes* by the river and a lot of blue dragonflies.

April 7, 1915.—The last three nights the 'wait' note of the frogs has been less noticeable, and a croak like that of a bubble of water breaking on the surface has taken its place. I found that it is not made in the water ; in fact the greater number of cries come from the drenched grass, and by listening carefully it can be heard in the depths of the termite hills. Later I caught some of the handsome little frogs that are responsible ; they were males of *Cassina senegalensis,* which differ from the females by having an adhesive disc on the throat. They were answered from the ponds, probably by the females.

I also caught specimens of *Arthroleptis minutus,* a little frog no larger than an English one when it emerges from its tadpole stage ; it grows no larger, of course. In swimming across the water it looks like a beetle, as it makes a strong backwater or rather cuts two ripples.

April 9, 1915.—On nearing the edge of a wood in which I was, I saw through the leafy screen of bushes which concealed me, no less than eighteen buzzards (*Buteo desertorum*), bowing and scraping to one another and stretching their necks almost

in a row and well within an area of 25 feet by 5. Seven birds were in a space not more than a yard square, and all were within a hundred yards of where I stood. Hundreds of ant-lions were fluttering and settling in the grass.

April 17, 1915.—After a pouring wet day, I took a stroll over the sodden ground opposite my house; most of it was under half an inch of water. On the outskirts of the forest were numbers of delicate white irises that look exactly like narcissus and smell like narcissus, which I thought they were till put right by one of the Agriculture Department folk. Nearly trod on a Gunther's garter snake (*Elapechis Guentheri*) which was sluggishly winding its way through the sparse herbage; I easily bagged it. This snake belongs to the same sub-family as the cobras, and is very handsome. The general colour is a plumbeous grey, but this is broken up into half-inch bands by white bands, each of which has a red centre; the effect is very like that of the better-known coral snakes of America. There were twenty of these bands on the specimen, and they are not rings, as they do not extend to the lower surface. Caught a *Chameleon Jacksoni* on a coffee-tree in the garden. I hung a leafless twiggy branch on to the electric light cord in my bedroom and put it on it; the creature, however, climbed on up the cord and carried the branch up with it, having taken a firm grip of it with its prehensile tail. They must be pretty strong in caudal muscles, one would think.

April 24, 1915.—Went up to the Provincial Commissioner's at 5.45, and caught two oleander hawk moths (*Chœrocampa nerii*), two striped hawks (*C. celerio*), and twenty-nine convolvulus hawks (*Sphinx convolvuli*). It is interesting to note that these species are common to England as well as Africa, but the English entomologist who made such a catch in one night would become delirious. I must have seen at least a hundred of the convolvulus hawks. Saw a Jackson's chameleon when riding in this morning; it was standing on the top of a fence waving its arms about, so I pulled up and rescued it, and rode into Nairobi with it on my helmet.

May 1, 1915.—Went out on the plains and walked along by the river. A month ago this was dried up with the exception of a few pools; now a little torrent fills the river bed, the grass

reaches to one's waist, and in places the shoulder, where a few weeks ago there was nought but dried stubble. Walking thus in the tall grass I put up a fine female bushbuck from its form; in two bounds it was at the river, which in a third it cleared; a splendid picture it made in its fresh fawn coat against the vivid green grass and the running water. I should like to have said blue water, but as the natives wash their clothes in every river round about, it would have been more picturesque than true. For fifteen miles in the direction in which the antelope made off there was no cover save for a clump of bushes fifty feet from where I was, and into this she disappeared with such suddenness that one had to rub one's eyes and look at the vacated form less than five feet away before being certain that the whole thing was not a delusion of the senses.

The only birds worthy of mention were a heron and a marabou stork. All about the plains were the red-necked whydah birds (*Coliuspasser laticauda*), the males of which are a deep velvety black with a brilliant scarlet collar; their tails are one and a half times the length of their bodies. The females are insignificant little birds of the same size and general appearance as an English hen sparrow. The name 'whydah' I believe is derived from 'widow,' as other species are distinctly reminiscent of 'widow's weeds.' The lengthy tail seems to hamper the bird in flight and leaving the grass or bushes; and I saw one with its tail at right angles along the branch. Unwieldy as they appear, attempt to catch one, and you always just fail; at the eleventh hour he seems to get under way. The male, or sometimes two, dance round and round the hen, who sits in the grass, in their efforts to display their good points, till they finally wear the grass down; I came across several of these rings almost bare of grass and about eighteen inches in diameter, with the central tuft standing in the middle on which the hen had sat.

Saw two green snakes, probably *Chlorophis neglectus*, basking on the foliage of bushes overhanging the water; they both escaped by diving into that element. Later on, as I was returning for my bike towards the P.W.D. work-shops, which are situated on the hillside overlooking the

plains, a 'boy' came up to me with a stone in his hand, saying they had disturbed a 'Nyoka kubwa sana' (very large snake), whose diameter he indicated was the size of his wrist. I went off with him at a run, and on nearing the shambas or native allotments saw a smoking pile of rubbish and two boys standing by. About fifteen others were standing afar off and shouting what I expect was the very best of advice. When I came up they began to rake away the rubbish with long poles, whilst I stood ready with my forked stick. Presently a black-necked spitting cobra (*Naia nigricollis*) came gliding from the heap. The boys discreetly retreated, and the snake turned up over the pile, making for the fence against which the heap had been thrown. I pinned it six inches back of the head first go off, and shielded my face with my helmet, as these pretty creatures have a dirty habit of spitting their venom at one's eyes; this causes a temporary blindness lasting several days and extremely painful. I have met several people out here who have suffered in this way, as also the keeper of the reptile house in the London Zoo. They can spit at the distance of twelve feet, and aim for the eye every time.

With all the rubbish and brambles sticking up, and his lordship slamming about, I couldn't very well have picked it up, and the boys were shouting lustily for me to kill it, and the two at hand, making menacing gestures with their poles, having returned. As I was telling them that I would not kill it, and to keep away, the snake settled the matter by giving a quick muscular contortion and freeing itself; it turned straight in my direction, but without any idea of attacking; the boys left hurriedly, and I jumped backwards off the pile. She was very quick, and turned again for the fence like lightning. In the excitement of the moment, and as it was within six inches of the fence, I gave it a blow on the back which stunned it. The top flew off my snake stick, and the snake did not move. I gave it another tap, to which it only responded by wriggling its tail, so creeping up I recovered the fork and replaced it in the ferrule, and then pinned the cobra by the back of the neck. Picking it up, and keeping the head well away from me, I transferred it to a bag, one of the boys holding

one side for me—a thing I should not have cared to do for anyone else.

When I got back to the Museum, though it was possible the cobra might have since died, I took no risk, and turned it out on the grass just outside. It began to cavort around, so I again pinned it, and lifted it into a small snake case (2ft. × 1 ft. × 1 ft.), in which there was already a close relative of the cobra in the person of a Gunther's garter snake (*Elapechis Guentheri*) caught a few weeks ago. I placed the case in my office with a ten-pound jar of formalin on the top of the very light perforated zinc lid. Next morning on entering the office, the snake sat up, spread its hood, and fired two shots at me, the venom running down the glass. The ten-pound jar of formalin was a foot away from the case, the stopper in another place, and a pint of formalin five feet away in the middle of the room. I have never learnt what happened ; my own theory is that my boy, who was out on the plains, but missed me, returned after dark with some insects for the lizards which he has to feed. Entering in the semi-darkness, he removed the lid, and had the time of his life when the snake sat up. He denied having been in, but someone had, and he alone has a key besides myself.

I kept her alive for a fortnight, hoping to send her home, but could find no one I knew sailing by the next boat, and as it was cruel to keep her in so small a case, and I was unable to clean it out, having nowhere to transfer her to, I chloroformed the whole lot in the case. When I put in the cotton-wool she had two parting shots, discharging quite a lot of venom. The length was 4 feet 5 inches, and the thickness, for two-thirds the length, that of a broomstick. Unlike all the other examples of this species I have seen, the throat was marked with yellow, and not scarlet, underneath.

To return to the account of the afternoon's outing, which the relation of the above has interrupted. On the water I saw a large red dragon-fly, larger than the biggest species ; only one appears to rule each stretch of water, and they prey on other dragon-flies, as, for instance, the following. I was watching a male of a typically sized species flying about, holding a very differently coloured female by the neck and at last

they settled on a stone, and I prepared to stalk them when suddenly along flashed one of these red dragon-flies ; a sharp scuffle and rustling of wings in the air, and in less than twenty feet from where I stood, the larger insect had carried off one of the happy couple. Every time I have failed to capture one of these big creatures. Brought home a web of caterpillars with a hundred caterpillars ; I left a lot behind.

May 3, 1915.—Cycled out on the plains to Kell's farm, about six miles out. Chased butterflies on my bike across the plains, which is quite good riding compared with some of the municipal roads. A butterfly migration was in progress, and has lasted several days ; it is a wonderful sight, and only one species is taking part in it—*Catopsila florella* ; the male might easily be mistaken for that of the English brimstone, the female is more orange than *Gonepteryx rhamni.* They drift along with the wind like snowflakes. Of course they are very sparse, but as far as the eye could scan, they could be seen, and as it went on unceasingly for days, thousands of insects must have taken part in it. Another remarkable sight was a bush something of the size and appearance of an English laurel smothered in caterpillars and their webbing. They had nearly stripped the bush of all its leaves. On a bridge over a stream I took two fine blue wasps (larger than an English hornet) at work on their mud nest, which was over a foot long. What interested me most was that a brilliant metallic green cuckoo bee was waiting placidly by the entrance for one of the owners to retire—I captured it also.

May 5, 1915.—Caught a Cape wolf snake (*Lycophidium capense*), whose tail I observed sticking out of the galvanised side of an outbuilding. I fetched a pair of forceps and hauled it out. The species is harmless, though rather addicted to biting, hence its name, and also on account of some large teeth supposed to resemble canines.

May 9, 1915.—One of the thin-waisted black-and-yellow wasps (*Sceliphron*) has been building a mud nest on one of my bookshelves, and I surprised her for the first time. It was a surprise to me too, for I caught a number of this genus some while ago at Kabete, and they were all hanging on to a paper nest from the verandah roof ; that species was *quadri-*

punctata. This one commenced by putting a strip of mud in the angle between the shelf and the side and rounding the corner off nicely. I might add that she has never been back to the nest since that day, though not molested in any way.

Cycling in to Nairobi, I picked up the slightly injured remains of a blind burrowing snake (*Glauconia eminii*),which I was delighted to get, as it was a representative of the only family found in the Protectorate, and not represented in the Museum collection. Kell's also gave me a species new to the collection yesterday—a little olive snake with a jet black head known as *Aparallactus Jacksoni*, and first discovered on Kilimanjaro ; it must be pretty rare, I think. There are some crowned hornbills (*Buceros cristatus*) in an adjoining garden to where I reside, and each morning the flock passes over to the forest with loud cries. They are handsome black-and-white birds, with enormous beak development, and my neighbour shot three with a rifle for the Museum ; they were beautifully killed, with scarcely any blood, and made up into very nice skins.

May 15, 1915.—A local resident cycled with me to Ngona Forest, where he has collected some magnificent swallow-tail and other butterflies. The forest is about twenty miles in length, and varies from one to two miles in width. Leopards are said to be quite common there still, and a fellow-boarder at my place saw two lions there together, and a third later in one day ; this was four years ago, however, and they have doubtless retired to the denser parts of the forest. The weather was dull, but close and steamy, and though we got nothing of especial note, we enjoyed the outing very much. The forest was very lovely, and along the middle of it flows a river in a very deep ravine. On the roadside I caught a live *Glauconia eminii*, about nine inches in length and scarcely thicker than the lead in a pencil ; it makes an uninteresting pet, as it burrows into the soil, and only once have I seen it out in the sun, when it was twisting about in the branches, They are very difficult to hold, as they flow about like quicksilver.

May 21, 1915.—Just near my rooms I found a Reichenow's weaver bird nesting, and a second building ; the bird is a vivid yellow, with some black about the head and wings. Scores

of black-and-white humming-bird hawk moths were hovering over the inflorescences of a heather-like plant (*Ocimum suave*). I caught a dozen. Another moth has just made its appearance in considerable numbers, and is like a huge yellow underwing, but with gorgeous metallic upper wings. I caught a number in the long grass, where they were sitting head downwards waiting for the shades of night. By far the best way of catching butterflies is after sunset, when there is half an hour before dark. If one walks through the long grass, especially on the outskirts of a wood, they may be seen clinging to the grass stems, and so numbed that they may be gently lifted off with the left finger and thumb for examination ; if they are damaged, replace them, and they will go to sleep again, perhaps shifting their position a little. If in perfect condition, a nip in the thoracic region with a pair of tweezers in the left hand ends their joys and troubles in this life at least.

I have seen a dozen swallow-tails of the common species all grouped about in a square yard or so of grass in this way, and have been able to select one or two of the best in the manner described. Next year I hope to take up photography and get a view of this, as it would make a pretty picture, especially in colour. This week I have come across several clusters of the black larva of a grasshopper on the bushes or tops of plants ; they are also a novelty to me.

May 22, 1915.—Two eggs in the Reichenow's weaver bird's nest ; nothing in the second. Took a fine clearwing hawk moth and a dozen striped at flowers.

May 24, 1915.—Went out on the plains, where we (that is, my boy and self) found several nests and eggs and a score building : a shrike's with two eggs, a finch's with three, two red-necked weaver's with two and three respectively, another weaver's with mottled brown eggs—two, and a third weaver's with five small white eggs and one large. All the birds were sitting. These weaver birds' nests are very like those of a willow wren, only built a foot from the ground and fixed to the grass stems after the manner of an English reed warbler. I found nearly twenty nests in course of construction—just an oval of grass firmly fastened to the stems ; another had young in it.

Caught one snake under a sack; it was a young wolf snake. There were some fine large *Elater* beetles quite $1\frac{3}{4}$ inches in length, and they made a very loud clicking when secured.

DISCOVERY OF MALE OLIGONEURIA DOBBSI

By C. M. Dobbs

On June 7, 1915, while camped about ten miles from Kericho about 7 P.M., another specimen of the *Oligoneuria Dobbsi* was discovered on our camp table in a state of collapse. It was apparently uninjured, and had been overcome by the heat or light of the lantern. We sent the specimen home at once to the Imperial Bureau of Entomology, and a letter has just been received stating that it is the unknown male of the *Oligoneuria Dobbsi*, of which the female was described in No. 6, vol. iii. of the Journal of July 1913, p. 58. It seems a most remarkable thing that in the course of four years' residence in this district only two specimens of this insect should have been discovered at places fifty miles apart. Both specimens were discovered accidentally, and we have never seen another, although we have constantly been on the watch for them.

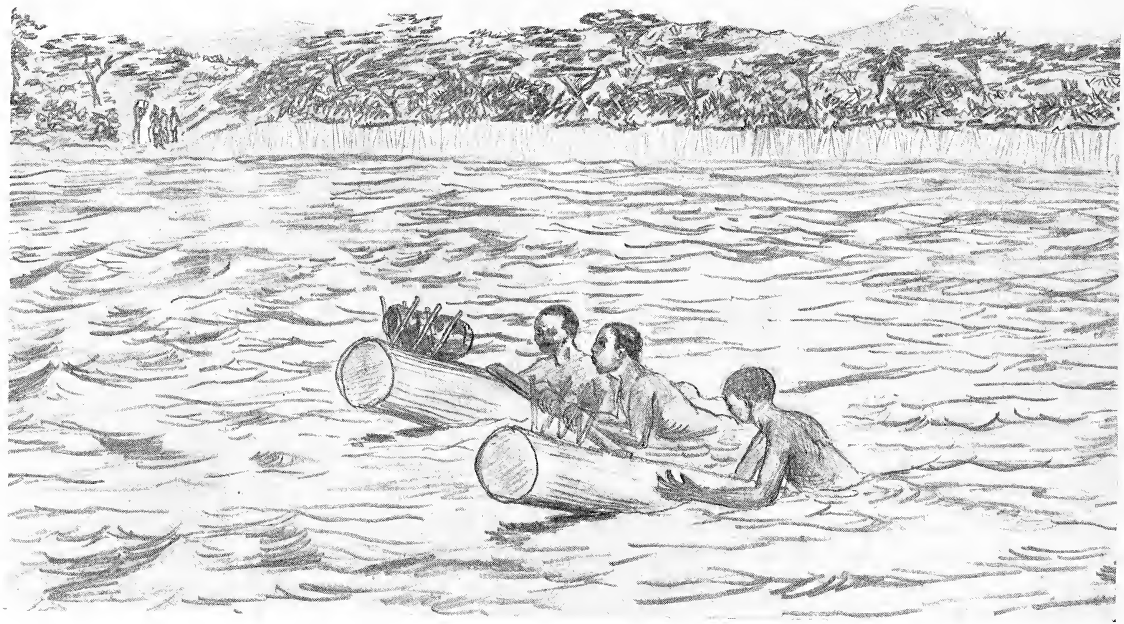
A PRIMITIVE FERRY

By H. R. Montgomery

While on *safari* on the Tana river in July 1915, with Mr. Barton, I came across a very primitive ferry at Kwa Ngombe ford on a road between Mumoni and Embu.

The ferry is owned by two Embee who live some distance from the river and only come down periodically, or on appointment, so we were lucky to be at the place the day they were working.

A description of the ferry may be of interest; unfortunately



A PRIMITIVE FERRY.

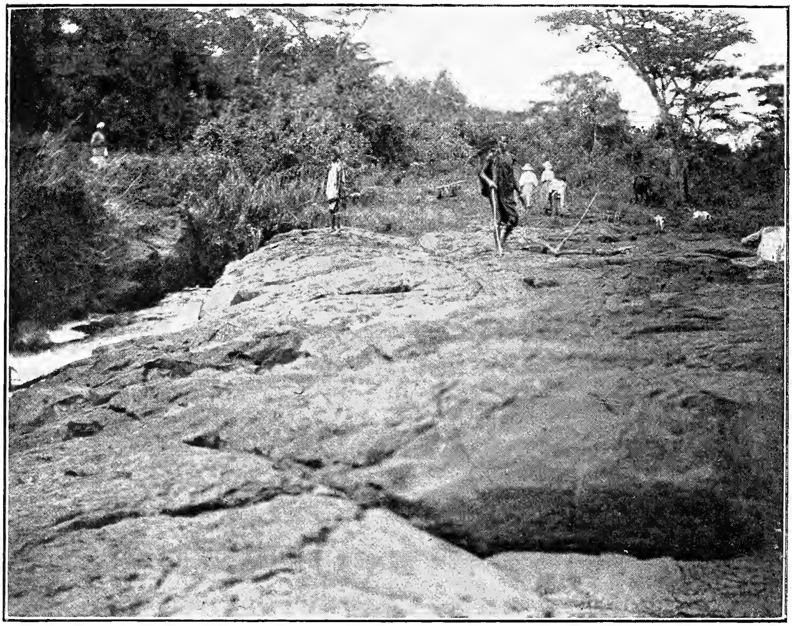


Fig. 1.

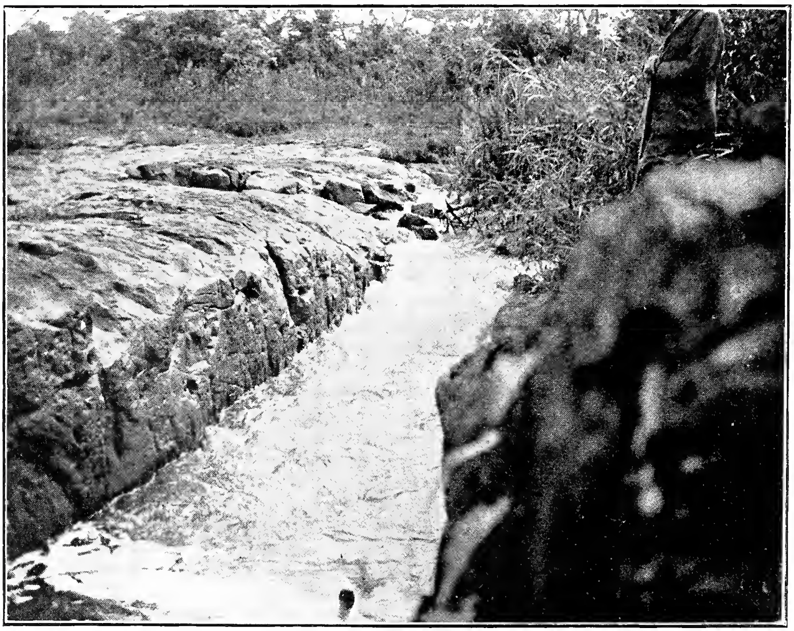


Fig. 2.

neither of us had a camera, but the accompanying sketch will give an idea of the craft.

Two honey-barrels are fastened about four feet apart with a pole between; and the two ferrymen lie one on each barrel, the lower ends of which are submerged by the weight of the men: the passengers, not more than two, hang on the pole between the barrels, and as they generally cannot swim, and the river is full of crocodiles, they do not enjoy the crossing; the faces of the men we saw just appearing out of the water were really comical.

At the top end of each barrel are six sticks which form a fork in which loads are placed.

The craft is taken 100 yards above the point they wish to land on, and is launched and carried rapidly down-stream, the ferrymen propelling it across by leg action.

Before starting, the ferrymen offer a prayer to 'Aimu' (good spirits) to protect them during the voyage, and either through faith in 'Aimu,' or because they are so used to the danger, do not fear the crocodiles at all; they say a man is occasionally taken, but will probably be a passenger. There is no doubt about crocodiles being there in great number—Barton shot one eleven feet long a few hundred yards below the ford where the ferry was working.

The reason so few people are taken by crocodiles is, really, that during the floods these animals are not so dangerous as in the dry season, when, of course, people can ford the river and the ferry does not work.

THE JAMJEE RIVER, LUMBWA DISTRICT

By C. M. Dobbs

The following notes with regard to the disappearance of the Jamjee river underground may be of interest.

At a point about twelve miles from Kericho Station and two miles below the bridge on the main Kericho-Sotik road, the bed of this river is composed of a huge flat rock. When the river is not in flood this rocky bed is quite dry except

for pools of water left behind in the numerous holes (see Fig. 1). Just above this bed, which extends for about 200 yards downstream, the whole of the water turns aside almost at right angles to the direction of the main stream into a narrow channel in the rock about eight feet wide and disappears down a hole. This channel is shown in Fig. 2. The black spot to the left of this picture is the end of a pole that has been pushed down to try and locate the hole. There is a decided eddy here, and articles thrown in are sucked down. Fig. 3 gives another view of this cutting, showing the end of the channel where the water disappears. The rocky bed extends away to the right of the picture, and on following it down for about two hundred yards one comes to the edge—a sheer drop of about thirty or forty feet, at the bottom of which the water comes out of a cave under the rock (see Fig. 4). One can crawl in a very considerable distance, and the natives bring their goats here to get salt. In the rains, of course, the river sweeps right over this rock and forms a very fine waterfall.

ELAND AT THE COAST

By E. K. Boileau

When returning overland from a visit to Kipini in 1914, I came across a herd of eland on the high land over Fundi Isa, out of which I secured two full-grown males. The second was shot accidentally in the thick bush in mistake for the first bull, who had got away wounded. There were several cows in the herd—about eight, I think.

The oldest inhabitant at Fundi Isa had never seen or heard of eland there, nor, indeed, have I been able to hear of anyone having ever done so. The name of 'mpofu,' the Ki-Swahili for eland, is unknown even at Malindi. I shall be glad to hear if any readers have known of a similar case.

The distance to the sea from the place where they were shot was roughly two and a half miles.

Rhino are also to be found near Marareni on the coast.

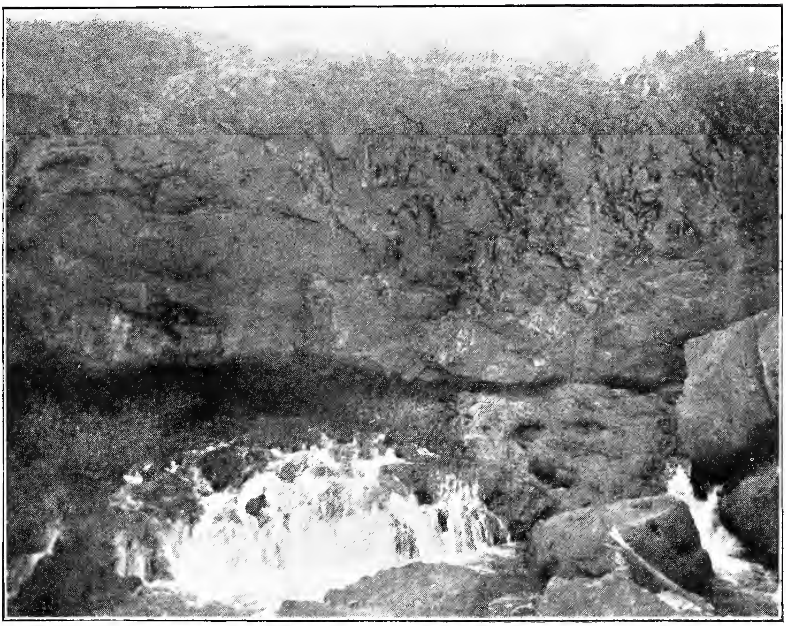


Fig. 3.

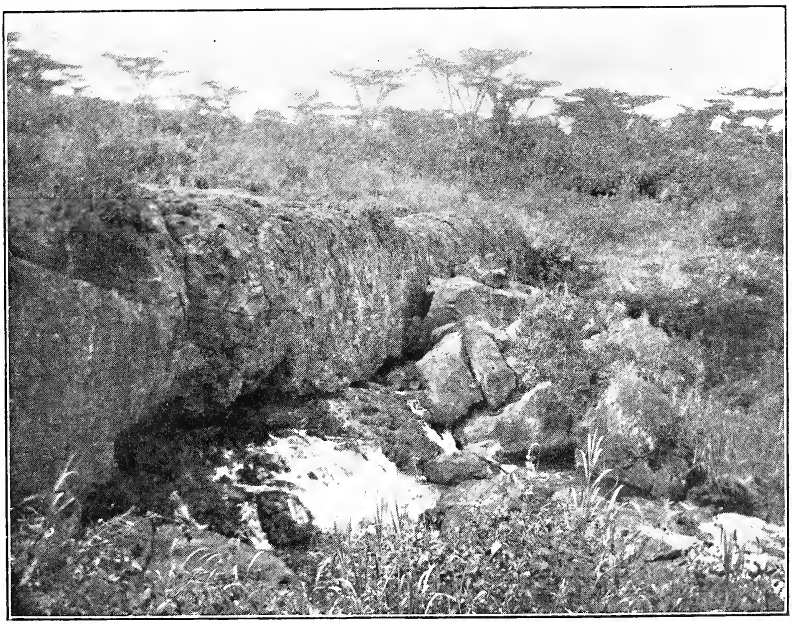


Fig. 4.

It may not be generally known that elephant breed near Lake Karawa in the thick bush to the east of the so-called lake, which of late years has dwindled down to a small swamp. There is one herd that appears to live all the year round in this vicinity, alternately visiting the thick fibrous bush to the west and the eastern bush, which is mainly composed of makoma palms, the fruit of which they are exceedingly fond.

BIRD AND SNAKE

By Capt. A. Blayney Percival

At Voi Camp last November, I surprised a sand boa (*Eryx thebaicus*) endeavouring to swallow an Asiatic dotterel (*Eudromias asiaticus*), which proved to be too much for it, although it twice made the attempt.

CURATOR'S REPORT ON MUSEUM PROGRESS FOR THE YEAR ENDING DECEMBER 1915.

On entering upon my duties at the Museum in January last, I found that next to the preliminary campaign with scrubbing-brush and duster, the most pressing need was for the installation of a registration system for the material already accumulated at the Museum.

A series of twelve volumes were commenced; each of these registers represent a separate group, such as Ethnology, Mammals, Birds, Shells, Insects, and Minerals, and has its own index letter; they are numbered to take 9999 entries. All specimens found at the Museum on my arrival or received during the past year have been registered, and all data accompanying them entered up, with the exception of the seven hundred odd small mammal skins (which are awaiting identification) and the insects, with the exception of the butterflies, which have been done.

For facility in ready reference, the five-colour card-index system has been adopted, but so far cards have only been

typed for the vertebrates and lepidoptera. As no books on the fauna of the Protectorate have been published, the index had to be compiled from various scattered papers giving lists of material collected by the different scientific expeditions which have visited the country. The vertebrates required 4000 cards, lepidoptera 1000; each of these was separately typed, a lengthy process, but giving the neatest and best results. Separate colours are used for (i.) Orders, (ii.) Families, (iii.) Genera, (iv.) Species, (v.) Sub-species and varieties.

Mammals.—The collection of horned heads was carefully gone over, labelled, and arranged systematically on the walls. Skins were cleaned, and those which had been in pickle taken out, labelled, and packed in store boxes. The collection of skulls are exhibited in one of the cases.

Birds.—The large series of study-skins was gone over, fresh labels written, and the birds sorted and arranged according to their families in the drawers provided. A good many species new to the collection were added by the Curator and members.

The two exhibition cases were rearranged and the specimens provided with clearly typed labels in English and Latin.

Reptiles.—Several hundreds have been identified, the cases repainted, and the specimens rebottled in uniform jars of three sizes bought for the purpose; of these some three hundred were used. Some fifty species of snakes are on exhibition, and form a ready reference-collection to the commoner species. Next year it is hoped to show a better series of lizards than those now in the cases.

Fishes.—The Cuninghame collection of marine, and the Percival collections of fresh-water fishes have been rebottled, and for the present placed in the office.

Butterflies.—The Lepidoptera cabinet was thoroughly cleaned out and repapered; the broken panes of glass were replaced. Typed labels were installed and spaces left for the accommodation of five of each species. The *Nymphalinæ* are on exhibition in the top of the cabinet. Several hundreds of specimens have been set.

Shells.—These have been temporarily installed in drawers of the botanical cabinet until such time as the much-needed cases can be provided.

Minerals and Geological Specimens.—A selection have been exhibited in the two cases set apart for them, and all the specimens have been cleansed, registered, and duly labelled.

Office.—Some hundreds of acknowledgments have been sent out for specimens received, as will be seen from the list of donors published in the present number of the JOURNAL.

A very fine set of shelving has been fitted up to accommodate the reserve collections of spirit specimens. At the present rate of increase more will be required ere long.

A large work-table, about five feet by six feet, was got for the skinner, and has proved invaluable.

Future Work.—The specimens which will next receive attention are the beetles, which require relaxing; and will then be mounted on uniform white cards. The many hundreds of beautiful specimens when arranged in the twenty drawers of the insect cabinet reserved for them will make a fine nucleus for a B.E.A. collection. Other orders of insects will then be dealt with in rotation; card-indexes will have to be compiled for them and the other invertebrates.

OBITUARY

LIEUT. R. B. WOOSNAM

From 'Nature,' July 1, 1915

The death of Lieut. R. B. Woosnam, killed in action at the Dardanelles on June 4, adds one more name to the steadily increasing list of workers in science who have given up their lives for their country in this great war. Lieut. Woosnam served with the 2nd Worcestershire Regiment in the South African war, and it was during that period that he first became known to the Natural History Museum by sending to that institution a number of small mammal and bird skins, prepared so well that it was at once noticed that they were the work of a skilled collector and true naturalist. At the close of the war Woosnam offered his services to the Museum as a collector, and on the offer being accepted, he gave up soldiering for the time being.

In his new capacity he carried out a difficult piece of zoological exploration through the Kalahari desert to Lake Ngami, and in October 1905 he was appointed leader of the important expedition organised by the Museum for the exploration of the Ruwenzori range in equatorial Africa. His companions were Mr. R. E. Dent, a former brother officer in the Worcester Regiment, the Hon. Gerald Legge, Mr. Douglas Carruthers, and Mr. A. F. R. Wollaston. The expedition reached a height of 16,794 ft., and Woosnam records that butterflies, moths, and diptera were seen on the snow up to 16,000 ft., blown there by the almost constant wind. On the bare rocks above the snow-line a few worms, lichens, and mosses were seen. As a result of the undertaking the National Museum was enriched by a large number of species new to science, and a very valuable addition made to our knowledge of the fauna and flora of tropical Africa. In 1911 Woosnam was appointed by the Secretary of State for the Colonies game warden in British East Africa. He very quickly surmounted the difficulties of the position, and it speaks volumes for the fine nature of the man that though he carried out his duties in the strictest manner and confiscated with unsparing hand illegally obtained sporting trophies and other objects, there was no more popular official in the Protectorate. He was mainly instrumental in getting together the International Conference for the Protection of Wild Animals in Africa which met in London last year. It is no secret that he formulated stringent plans, which were virtually adopted, for the effective carrying out of the object of the conference. Now, alas ! all this is at an end, and with it has passed away a man of sterling character, of a lovable disposition, modest and unassuming almost to a fault, and an unflinching adherent to duty.

ANNUAL REPORT, 1915.

It is satisfactory to be able to report that there has not been any further considerable falling off in members during the year owing to the War.

The actual number of members on the roll on December 31 was 108 against 116 on December 31, 1914, a loss of 8.

Despite this, however, it would have been impossible to have retained the services of the Curator for another year had not Captain W. N. McMillan most generously come to the Society's assistance with an offer to pay the salary of the Curator for the ensuing year, which was gratefully accepted by the Committee.

This is the second munificent gift the Society will have received from Captain McMillan.

The work accomplished in the Museum during the year by the Curator, Mr. Loveridge, has been exceptionally good, as a visit to the Museum or a perusal of his report will show. Mr. Loveridge volunteered for active service and left for the front on December 27. Fortunately the Committee was able to obtain the services of Mr. H. J. Allen Turner (who is unfit for active service) to take up his duties. Mr. Loveridge and he have come to an arrangement regarding remuneration whereby the Society is not involved in any more expenditure than would have been incurred had Mr. Loveridge remained at the Museum.

The manuscript for Journal No. 9 was sent to the publishers, Messrs. Longmans, Green & Co., in April, 1915, but so far no copies have been received. The delay in printing is explained by the rush of war work and the shortage of staff occasioned by the War. The manuscript for Journal No. 10 is almost completed and will be sent home shortly.

An Illustration Fund has been opened on the initiative of Dr. Van Someren, which it is hoped may attain such proportions as will enable the Editor of the Journal to increase the number of illustrations in subsequent issues.

Donations have been received from the following:

A. M. Jeevanjee, Esq.	£50	0	0
S. S. Bagge, Esq.	10	0	0
J. Graham Dawson, Esq.	2	0	0
F. Burmeister, Esq.	2	0	0

which are gratefully acknowledged.

It is gratifying to note the increasing interest taken in the Museum as indicated by the number of specimens received by the Curator from various donors in all parts of the country.

The funds which His Excellency the Governor, Sir H. C. Belfield, collected for the Museum Building, &c., Fund are shown in the Annual Accounts for the first time, having been formally handed over to the Society at the beginning of the year.

It is with deep regret the Committee records the death of Lieut. R. B. Woosnam, who was killed in action at the Dardanelles on June 4 last. Lieut. Woosnam had been a member of the Committee since his arrival in the country in 1911, and had taken the keenest interest in the Society's activities, which he was always ready to help in any way.

The Committee feels that it has lost a valued colleague and friend as well as a worker in the cause of science whose wide knowledge was of the greatest value to the Society.

The assistance that the Society has received from various individuals during the year by donations to the funds, already detailed above, contributions of specimens for the Museum, articles and notes for the columns of the Society's Journal, is again gratefully acknowledged.

The thanks of the Committee are also due to Mr. S. E. J. Howarth, the Honorary Auditor, who has audited the accounts for several years.

JOHN SERGEANT,
Honorary Secretary.

NAIROBI, *February* 3, 1916.

EAST AFRICA AND UGANDA NATURAL HISTORY SOCIETY.

BALANCE SHEET FOR 1915.

RECEIPTS	Rs. Cts.
BY	
Bank Balance, January 1, 1915	2,795·22
Subscriptions in arrears	97·50
Full Members' Subscriptions, 1915	1,275·00
Associate " "	165·00
Donations	960·00
Hire of Museum, from December 1, 1914, to January 7, 1915 (Game Warden's tenancy ceased, 15)	61·29
Sale of Journals	18·00
Refund of Advances to Curator	62·50
Illustration Fund	127·50
Sundry Receipts	127·07
	Rs.5689·08

EXPENDITURE	Rs. Cts.
TO	
Expenses of publication of Journals	622·01
Rent of Museum (January 1 to December 31, 1915)	450·00
Postage, Telegrams, Cheque Books, Exchange on cheques and drafts	45·63
Printing and Stationery	71·75
Museum Equipment	560·09
Museum Upkeep and Expenses	279·46
Salaries and Allowances	2795·65
Electric Lighting & Electric Lighting Fees on plot of land reserved for Museum	26·00
Balance in Bank, December 31, 1915	838·49
	Rs.5689·08

Audited and found correct,
S. J. HOWARTH.

JOHN SERGEANT,
Honorary Treasurer.

January 29, 1916.

EAST AFRICA AND UGANDA NATURAL HISTORY SOCIETY

MUSEUM BUILDING, &c. FUND.

Receipts	Rs. Cts.	Expenditure	Rs. Cts.
1915		1915	
January 27th. Bank Balance—		December 31st. Balance on hand—	
Fixed Deposit	4500·00	Fixed Deposit	4500·00
Current Account..	99·94	Current Account	99·94
	Rs.4599·94		Rs.4599·94

No interest had been credited on December 31, 1915, as the twelve months of deposit had not been completed.

Audited and found correct,
S. J. Howarth.

John Sergeant,
Honorary Treasurer.

January 24, 1916.

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1. Aders, Dr. W. M.
2. Anderson, T. J.
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56. Lowe, Rev. W. P.
57. Lynde, W. M.
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59. Luckman, Mrs. A. O.
60. Martin, I. G.
61. McClelland, W. Arthur
62. Milne, Dr. A. D.
63. Montagu, M. S. H.

64. Montgomery, H. R.
65. Montgomery, R. E.
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67. Nicholson, John
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102. Watson, C. R.
103. Watt, H. L. R.
104. Weeks, R.
105. Wells, H. T. Thomas
106. Wiggins, Dr. C. M.
107. Williams, J. Hill
108. Wright, S. Warren

The Journal

OF THE

EAST AFRICA AND UGANDA NATURAL HISTORY SOCIETY

MARCH 1917 VOL. VI. No. 11.

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ILLUSTRATIONS

EDITOR
C. W. HOBLEY, C.M.G.

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♂

FRANCOLINUS L. SCHUBOTZI.

♀

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1917

CONTENTS

A RARE FOREST FRANCOLIN

Francolinus lathami schubotzi

By Dr. V. G. L. van Someren

Since the publication of the notes on 'East African and Uganda Francolins' by Sir F. Jackson, in Journal No. 1, vol. i., two very rare and interesting Francolins have been found in Uganda, these are *Francolinus lathami schubotzi* and *Francolinus nahani*.

There is no record of these birds having been seen or taken previous to my collectors having obtained them in 1913.

Francolinus l. schubotzi was described by Prof. Reichenow as recently as 1912, in *J. Ornith.* lx., p. 320, from specimens collected on the Uelle River in Belgian Congo, and *F. nahani* in 1905 by Dubois, from a single immature specimen, collected on the Ituri river, Belgian Congo. (Dubois, *Ann. Mus. Congo*, i., 1905, p. 17, pl. X.)

In these notes I propose to deal with *F. l. schubotzi*, and with *F. nahani* in the next Journal.

Francolinus lathami lathami was known as far back as 1854, when it was described by Hartlaub, its range being confined to Western Africa. The male of the sub-species differs from the typical bird in having the cheeks pure white or delicate pearl-grey; the cordate or circular spots on the under side not so large; and the abdomen white, with black cross-bars. The flanks are brownish with distinct white shaft-streaks outlined with black, and the under tail-coverts black, with white shaft-spots and stripes, and slight barring.

Females differ in practically the same way as do the males, but the most striking difference is the colour of the cheeks, which in this sub-species is reddish-brown, not grey.

Young males resemble the adult males, but are more marbled and more rufous above, while the scapular feathers have ochraceous shaft-stripes.

With regard to the habits of these birds, little is known. They are birds of the dense forests, which fact would account for them being overlooked so long in Uganda.

They are shy and timid, and difficult to procure. Owing to their partiality for the thick forest, these birds do not fly swiftly nor far, but trust to their running powers to avoid pursuit. My head collector reports that the best way to find and keep in touch with these birds is with a good hunting dog.

These birds are usually found in pairs or small coveys. I have not heard them calling, but they are said to utter a low whistling note when feeding amongst the fallen leaves.

Breeding apparently takes place in May and June, during which months females have been collected with swollen ovaries and dilated oviducts. Young birds in first plumage have been shot in September.

So far, the only locality in Uganda where these birds have been taken is in the great Mabira Forest in Chagwe.

The frontispiece, representing male and female, gives one a good idea as to the plumage and form of these birds ; a noticeable feature is the slender bill and comparatively short legs.

The colouration of the sexes differs to such an extent as to lead one at a first glance to think that these birds represented different species. The fact that some females possess long spurs also adds to this supposition.

FISHING AT MAFIA ISLAND

By Editor

The waters around Mafia Island have often been highly spoken of as a favourite haunt of game fish. His Excellency the Governor recently had to proceed there on duty with his staff, so he determined to test the locality, and took with him a motor-boat.

At midday on September 24 His Excellency's party anchored some little distance from the island, and at 2.45 commenced

fishing on an ebb tide ; no natural bait was available, so spoons were used.

In about ten minutes His Excellency hooked a good fighter, which played hard for twenty minutes and then unfortunately broke away.

From there onwards hardly five minutes elapsed without a run, and the two rods had two hours' great sport. Three times each rod had a fish on simultaneously as the spoon passed through a school.

Four or five fish were lost after varying periods of play, and one broke away.

By 4.45 P.M. each rod had secured four fish, all King-fish (Nguru). It was noticeable that they were considerably lighter in colour than those from Mombasa, and they were desperately hard fighters.

The four His Excellency landed weighed respectively 22 lb., 18 lb., 16 lb., and 10 lb., and those caught by J. weighed 21 lb., 17 lb., 11 lb., and 10 lb.

On the way back to the yacht J. caught another of 16 lb.

This made up a total amount of nine fish for two and a quarter hours' fishing, weighing 141 lb.

They fished again on September 26 from 2.30 to 5.30 P.M., and had even better sport than on the previous occasion.

All the fish met with were King-fish, and at one particular part of the fishing ground the boat rarely passed over the spot without one of the fishermen getting a run.

Three or four times both rods struck fish at the same time, and on one occasion both were landed.

One of His Excellency's fish, a twenty pounder, met with a curious mishap. When gaffed into the boat it was found that the whole of the tail and after part of the body had been bitten off by a shark while being played, but nothing unusual was felt. His Excellency's share of the bag was seven fish weighing respectively 25, 20, 14, 13, 12, 11, and 9 lb.—total 104 lb.

J. landed four fish, 16, 14, 12, and 9 lb.—total 51 lb.

H. F. W. landed one fish of 16 lb.

Total for three hours' fishing—twelve fish weighing 171 lb. The same ground was fished over on September 27 from 5.30 to 8.30 A.M., and excellent sport was again the result.

His Excellency fished each day with the spoon only, but on the 26th and 27th J. used spoon and natural bait alternately.

On the 27th His Excellency killed seven King-fish weighing 20, 20, 18, 14, 13, 11, and 10 lb., also one small Barracuda of 6 lb.—total weight 112 lb.

J. secured five King-fish of 18, 18, 18, 14, and 14 lb. respectively—total 82 lb.

H. F. W. landed one King-fish of 9 lb.

Total for three hours' fishing on the 27th, 203 lb.

Thus during two afternoons and one morning the party killed thirty-five fish weighing altogether 515 lb., average weight 15 lb. The only regret expressed was that fishing ground had to be left so soon.

THE DESICCATION OF AFRICA

By R. L. Harger

This question is one that has formed the subject of many notes made during wanderings in Africa, extending over a number of years.

My interest in it was revived by the article by Mr. C. W. Hobley, which appeared in No. 9 of the Society's Journal.

I will first quote a few extracts bearing on the subject from the works of some of the older travellers, and will then venture to add some notes of my own observations.

The work called 'The Native Races of South Africa,' by George W. Stow, which deals with travels in South Africa from about 1843 onwards, contains some facts of interest.

(*a*) 'It is authoritatively stated that since the early days of the Korana occupation (end of fourteenth or beginning of fifteenth century) of the portion of the country we are now speaking of (South O.F.S. and N. Cape Colony) a great alteration has taken place in its water supply. Then the Kuruni is declared to have been a great river, which sometimes rose and continued high so long that women who happened to be on

the other side at the time of its rise frequently lost all hope of being able to recross it and, in their despair, married other men. It is also asserted that great quantities of reeds grew in it. Much water is said to have come down from the Molopo, which formed a junction near the Korana village as well as down another river called Misiri. The Koranas stated that the Battaru dried up the rivers by witchcraft.'

(*b*) 'The Bushmen state that in the days of their forefathers a number of large animals lived in the country which became extinct and disappeared from the face of the earth. On the plains drained by the Swart Kei, giraffes browsed on the trees of the Tsomo and other portions of the lower country. Immense herds of buffalo must have frequented the brakes, and thousands of elephants roamed through the forest glades, not only of the coastline, but also in every portion of the country, while the abounding hippopotami laved their sides in every deep pool to be found throughout the land. *Instead of the deep chasms now found cutting through and draining the water from the plains,* chains of deep Zeekoegats or hippo pools occupied their place, and wide spreading beds of reeds not only surrounded them, but frequently linked them in one unbroken line.'

(*c*) 'Such then are the companions of the Bakalahari, whilst the Kalahari which affords them shelter and protection, is also one of the last places of refuge of the fast disappearing Bushman race. This great area has been called a desert because, though intersected by beds of ancient rivers, it contains no running water and very little in wells. The beds of the former streams contain much alluvial soil, which being baked hard by the burning sun, rain water in places stands in pools for several months of the year.'

(*d*) Visit of J. Campbell to Battaru, a branch of the Bakuena, 1820, 'Lakesi' (chief) stated that when he was a boy the Koeromanie river ran along the desert, but since that time it has ceased to do so.

'Dr. Livingstone's Travels' also contains references to this question. Writing of his journey to Lake Ngami in 1849, he says: 'We proceeded down the dry bed of the River Makoko. The name refers to the water-bearing stratum before alluded

to, and in this ancient bed it bears enough water to admit of permanent wells in several parts of it. The ancient Mokoko must have been joined by other rivers below this, for it becomes very broad and spreads out into a large lake, of which the lake we were now in search of formed but a very small part. We observed that, wherever an ant-eater had made holes, shells were thrown out with the earth identical with those now alive in the lake. The water supply of this part of the river system, as will be more fully explained later on, takes place in channels prepared for a much more copious flow. It resembles a deserted Eastern garden, where all the embankments and canals for irrigation can be traced, but where, the main dam and sluices having been allowed to get out of repair, only a small portion can be laid under water. In the case of the Zouga the channel is perfect, but water enough to fill the whole channel never comes down. It (Ngami) is shallow. It is with difficulty cattle can approach the water through the boggy reedy banks. These are low on all sides, but on the West there is a space devoid of trees showing that the waters have retired thence at no very ancient date. This is another of the proofs of desiccation met with so abundantly throughout the country.'

Livingstone, in his mention of the journey of Dr. Cowan and Capt. Donovan through Bechuanaland in 1808, says: 'The Bakwains were then rich in cattle,' and it is one of the many evidences of the subsequent desiccation of the country that streams are pointed out where thousands and thousands of cattle formerly drank, and in which now no water flows. (1845–1849.)

During his residence at Kolobeng from 1845 to 1849, Livingstone reported: 'In our second year again scarce any rain fell. The third was marked by the same extraordinary drought, and during those two years the whole downfall did not amount to ten inches. The Kolobeng ran dry, and so many fish died that the hyænas from the country round collected to the feast, and were unable to clear away the putrid mass. A large old alligator (crocodile) was left high and dry in the mud among the victims. The fourth year was equally unpropitious, the rain being insufficient to bring the grain to maturity.'

Since Livingstone's day the process of desiccation has not abated in the south-central plateau of Africa, but in news from South Africa I have lately heard that Bechuanaland is again being used as pasture land by white settlers—this being possible owing to very extensive water-boring operations for watering stock.

From 1894 to 1903 I travelled through several of the districts mentioned above, with Livingstone and others for reference, but did not know enough to grasp the magnitude of the subject until I went north of the Zambesi in 1903. The above extracts are from the Library books.

My observations then extended to Lake Nyasa, south end and western side; the Loangwa Valley, nearly whole length; Lake Tanganyika, south end; Lake Mweru, north-east and south shores, including the Luapula river; Lake Bangueulu, almost right round; and Chambezi river (extreme source of Congo), which rises at Mt. Sunzu near Abercorn (South Tanganyika District), south side of Nyasa, Tanganyika plateau ridge. In every direction the words of Moffat, Oswell, Vardon, Livingstone, Harris, Selous, and other early South African travellers could be applied, almost word for word, with certain reservations. My notes were mentioned in my reports to the Chartered Company, 1903 to 1906, when I was investigating the distribution of Tsetse, Game, Native Products, Timber, &c.

The Loangwa Valley.—This valley, which is roughly forty miles wide by four hundred miles long north to south, discharges into the Zambesi. For two-thirds of its upper length it affords clear evidence of having held large areas of water for long periods. This is supported by the existence of miles and miles of old lake shores composed of well-rolled and water-worn stones and pebbles, which can be traced for great distances in the thorn bush at distances of sixteen to twenty miles from the present sandy bed of the dwindling river.

Mr. W. P. Kenelly (who was then Native Commissioner of the District) and myself traced some of these old shores for miles through the dry thorn bush country. They have in many places been cut through by sandy stream beds, which now never hold running water, only rain season pools. Nawalia Bowa, sixteen miles from the river, was an excellent point for

observation, being on a foot-hill of the Muchinga range, and with well-defined ancient beaches in its vicinity. All the beaches throughout the valley are evidently not on the same level, and therefore cannot be of the same age. The intervening flats between old beaches and present river are of deep alluvium, and are still inundated for miles during a good rainy season, but the water soon drains off. There are very few depressions with permanent growth of reed, such as can be seen at the salt lakelets of Pachicherri, some thirty miles south of Nawalia. (Cherri is the local Senga name for salt, which is an article of native trade.) The old shores are to be seen right up at the northern end of the valley, comparative levels of which could only be determined by careful survey. Since my travels in the valley it has been closed to travellers by the local form of sleeping sickness due to the local form of Trypanosome, *T. Rhodesiense,* which is carried in dry country by *Glossina morsitans,* not the moisture-loving *Palpalis.* The valley is bounded on the eastern side by the Nyika plateau, which rises to 7000 feet, and where *Juniperus procera* occurs as a rare tree. (Nyika means plateau in the local languages.) On the west the boundary is the Muchinga range (here again Muchinga means hills) which rise to over 5000 feet on to the Awemba plateau.

Lake Nyasa, south end.—From the present Domira Bay it is very apparent that the lake extended far south of its present limits in very recent times. The sand beaches can be traced for many miles back in a gentle rise. Native tradition and the present shallow, sandy, and muddy bay both denote that the water is receding. My personal observations do not carry me inland at this point for more than a few miles. In 1903 land was forming on a large scale with the assistance of extensive lines of native fishing barriers of reed, which readily takes root and grows. The same remarks apply to the low sandy shores of Kota-Kota on the western side. In both instances the recession of water is more noticeable than on the more northern shores, which abruptly rise from great depths to 3000 feet or more.

Some ten years ago Sir Alfred Sharpe published a paper in the *Geographical Society Journal* on the shrinkage of Nyasa and its southern extension Malombe. He also mentioned

that the Shire river sometimes flows slowly back into Lake Nyasa in exceptionally dry periods.

On the precipitous shores of deep bays such as Monkey Bay, Mkata Bay, and Karonga, the former water levels are very noticeable.

In 1895 the steamer *Queen Victoria*, 150 tons, was built and launched at a certain spot on the Shire river (below Lake Malombe), where in 1903 it was only possible to force through the vegetation a boat drawing three or four feet. I took note of the former water level, which was over ten feet above the then water level. The decrease of water continued to the extent that in 1910 the shallow-draught stern-wheelers with great difficulty managed to reach Port Herald at extreme south end of British Nyasaland. It has since been found absolutely necessary to extend the Nyasaland Railway southwards into Portuguese territory some forty miles.

Lake Shirwa (south-east end of Nyasa, near Zomba) is rapidly becoming a papyrus and reed-covered marsh. The surrounding country and flats towards Nyasa invite the conclusion that the Shirwa was an arm of Nyasa at no very remote date.

The Elephant Marsh, Chiromo, on the lower Shire, is no longer a marsh. My first visit was in 1903. Since then I have traversed it in many directions, and have camped in it for weeks on end away down towards the Zambesi and the Portuguese border. During the rains I have certainly had to circumvent stretches of water held in depressions by the kaolin sub-soil, but which rapidly evaporates when rains cease. During a long dry season one must depend on water holes in certain places. Some of these appear to be getting deeper and deeper every year by native efforts to reach the receding permanent water from the sloping hole down which steps were cut. With the records of Livingstone and Mackenzie to refer to on the spot, it was difficult to realise that so much and such expanses of water as they described had drained off and evaporated in forty years. The Sangasi, a tributary which enters the Shire at Chiromo, which must once have had a considerable volume of water, judging from old sand levels, 1905–1910, is now, except for a few days during the rains, a river of sand with well-defined banks which

are in places twenty feet high on the lower reaches. On the northern boundary of the plains are the Cholo Hills, down which several small streams flow from the plateau land, but these streams disappear into the ground after a few hundred yards on the flat. In one instance, to my certain knowledge, one stream sinks with very perceptible current into a small bed of reeds and does not reappear. It has often occurred to me that the underground water can here be traced by the position of the great belt of Borassus Palms (among which are a few Hyphæne Palms) which extends right across the flats in the Shire depression. These palms must have water, but they can go down twenty feet for it.

Lake Tanganyika.—Despite the rumours of alleged temporary rises in the water level of this large lake with a small basin, the general study of the shores shows the old story of permanent and steady decrease in the level, which perhaps has been more rapid than in the case of Nyasa. Even allowing for the fact that the strong winds, which blow from the north, have piled the sand into long dunes, it must be admitted that the sand had to be exposed in the first instance before coming under wind action. I speak now of Cameron Bay at the beaches, Kasankalawe and Mbete. Old beaches can be traced back right into the tree-covered land. At the former place the regular formation of the old beaches is very noticeable. Furthermore, fragments of delicate mollusc shells are to be found in the most recent beaches, but are lost sight of in the older ones, doubtless owing to the dissolving action of the overlying vegetable humus. I refer to two shells which are only found alive in permanently submerged sand. One is a very delicate Pecten-like bivalve, name forgotten, very fragile. The other is a new (1906) species—*Cleopatra Hargeri.* These forms, with many others more robust, must have been left by the water, and could not have been blown back such distances, even in fragments.

Such conjecture can be accepted when it be remembered that the old town of Ujiji is about three-quarters of a mile from the present lake shore, and so is the old beach where old natives, still living in 1906, remembered having dipped up water.

Tanganyika had one outlet on the western side to the Congo, the Lukuja river. I have it from Mr. Irwin (now in Mombasa) who was on the lake in 1890, that the old Arabs regularly took large dhows down the Lukuja and into the Congo. In my time the mouth of this river was nearly closed by vegetable growth, and no outflow was perceptible.

The Chambezi, Lake Bangueulu, Luapula River, and Lake Mweru.—These can be taken in the above sequence, and comprise the most westerly and perhaps one of the largest headwaters of the Congo. The Chambezi river is of fairly rapid, though fluctuating, volume. Most of its upper feeders, such as the Mansia, Luatikila, and Lukulu are permanent streams, which originate on the Chambezi-Tanganyika cum Nyasa watershed. On the flats towards Bangueulu the stream is considerable and well defined. It was once supposed to flow into Lake Bangueulu, but is now known to flow into the vast swamps at the south end of the lake. From these swamps another river arises known as the Luapula, which evidently takes the Chambezi water in addition to drainage from the lake and swamps. The Luapula then turns sharp to the north, passing Bangueulu to the westwards, and flows into Lake Mweru. Thus a continuous flow of permanent water can be traced and which continues in the Luvna, which flows from the north end of Lake Mweru into the Congo. But a different story is unfolded on examination of the vast flats on the east, north, and west confines of Lake Bangueulu. It is then that one can realise the former extent of the lake. Although Bangueulu is marked as well defined on most maps, it is in reality most difficult to define on its south end, because immense sheets of water occupy the old permanent lake bed during the rains. This water is held on the surface by the vast and continuous deposit of kaolin clay, bog-iron, and limonite, which underlies the whole country between the Chambezi on the east and the Luapula on the west. The lake has undoubtedly shrunk, but without these vast clay flats with a gentle fall lakewards, it is conceivable that the lake would by now have been yet smaller in area. Of course much evaporation must take place on the confines of this basin, where the water advances and recedes every year, but the

central portion is everywhere covered with great areas of water-loving vegetation, such as rush and other plants, which require shallow but permanent water. Thus evaporation is arrested. These areas imperceptibly merge with the sudd of the lake, chiefly composed of papyrus, of which there are huge floating islands interspersed by areas of open water.

On the south and east sides of the lake it is just about impossible to say when the lake proper is reached. On the north-west shores the lake is bounded by cliffs, rising in places to about fifty feet with sand beaches below. There are square miles of open water, too deep generally for aquatic plants and evidently kept clear of floating sudd by the prevailing winds from the north extremity, and very rapid desiccation is thus not so apparent in this Bangueulu basin of granite and allied rock which has decomposed into the impermeable kaolin clay. In two places I found outcrop ridges of granite near the lake laid bare by running water. A strange sight where stone is otherwise absent.

The Luapula River, which forms the Belgo-British boundary, is a large river 500 to 600 yards wide in parts. It is flanked for the most part by large lagoons and swamps, especially on the Belgian side. Nevertheless, examination of the adjacent country leaves no doubt that these lagoons are but remnants of extensive chains of lakes through which the river has run as a drain, like water draining from a mud flat. After leaving Bangueulu and turning north it flows over a rock bed of horizontal strata, which produce short falls and rapids for about half its length. From thence onwards to Lake Mweru, lagoons and swamps are much in evidence, and through which the river runs.

Lake Mweru.—This well-defined lake, some seventy miles long by about thirty wide, does not show signs of extreme shrinkage, although a slight rise in its present level would again inundate its old western extension, now a fertile plain about twenty miles by ten. Within a mile of the north-east end are dry flats and diminishing swamps, but the height of the intervening land ridges leads to the conclusion that these flats belong to the Luvna and Lualaba (Upper Congo) system of drainage. The same can be said of the Choma river and

marshes which lie between Mweru and Tanganyika and run northwards.

Of the Luvna I know little. There are vast sheets of open water and reed marshes along its course, linked up in endless ramifications, as occurs elsewhere in this region of Congo head-waters. Such abundance of water can hardly be included under the heading—desiccation.

In reviewing the foregoing facts, the inland plateau of Africa, up to the Equator, can be roughly divided into three lateral zones :—

1. From about the latitude of the Orange river to the Zambesi, where vast rivers and lakes have disappeared, leaving mere remnants, such as Lake Ngami.

2. From the Zambesi to the latitude of Lake Mweru, where large river systems and huge lake areas are in process of being drained.

3. The Equatorial belt, excluding Tanganyika, where the climate, rainfall, and vegetation is such, together with abundance of water, as to warrant the supposition that drainage and desiccation have not yet commenced.

With the aid of geology and palæontology, a fourth zone can be investigated in the north of Cape Colony and south of Orange Free State, where a semi-fossil form of *Cobus* has been found (cannot name exact locality without my notes). This form of *Cobus* is regarded as intermediate between the highly specialised, long-hoofed and water-loving *C. lechwe* and *C. ellipsiprymnus*. (*Vide* 'Animals of Capetown Museum and South African Geological Society.')

The Loangwa Valley is worthy of special attention. Drainage evidently took place here on a large scale, and at a time when the lake areas were fully inundated and were impassable barriers to certain dry land fauna, such as Giraffe, Suni (*Neotragus*), and Spiny Mice (*Acomys*) (to mention extremes in size), on their migration to South Africa.

Take Giraffe ; it is a native of North and East Africa down to German territory. It is also a native of South Africa. In the Loangwa Valley there was one known herd of some dozen animals in 1903. I knew this herd, which was pro-

tected by the Administration. In all the country on either side of the valley, i.e. Nyasaland and Mozambique to the sea on the east and the lake areas on the west, it does not exist. I am convinced that the former distribution of African water has had much to do with the distribution of its present fauna and native races.

Giraffe, Oryx, one Gazelle, the Springbuck, White Rhino, and Ostrich are South African forms (south of Zambesi). They are also North African forms. There are many other instances. In the intervening belt, with its east to west distribution, they are unknown in the Central Lake areas. They probably reached South Africa by way of the Loangwa Valley on the east and Damaraland and Angola on the west. This theory I base on the present lines of zoological distribution. Conclusive evidence can only be obtained from the geology and palæontology of these regions (Loangwa and Bangweolo), about which, in these respects, very little is known.

The report of the Irrigation Commission on the Orange River basin, carried out some twelve or fifteen years ago by engineers from India, also contains some interesting facts regarding desiccation.

GAME FISH IN TANALAND

By R. Skene

Koli-Koli

Scombridæ—near Tuna Group

Migratory Habits.—During the first days of June the first koli-koli are caught—that is, as soon as the big rains are over and the sea inshore has become clear. They continue to increase in numbers till the end of September, when they reach their maximum. In October they begin to decrease, and go on decreasing till about the end of January. In February and March there are very few indeed. In April and

May there are none at all, except, perhaps, one or two may be caught well out to sea.

Breeding.—It is not known where they breed. The roe found in the fish is about the size of millet. No young fish have been seen in the vicinity of Lamu.

Haunts.—They frequent both shallow and deep water, preferably the latter. It is not known whether they migrate to and from the Persian Gulf, but they are also to be found there.

Bait and Methods of Capture.—This fish is frequently caught with a hook and line, the best bait being 'kamba' (prawns), 'dome' (octopus), and 'mkisi' (mullet). It is also caught in nets dragged to the shore between two canoes and then pulled up on to the shore. It is found also in fish-traps in the creeks and harbours.

Other Information.—The koli-koli is called the 'maridadi' (dandy) of the sea owing to its liking for clear water, and its refusal of any bait that is not absolutely fresh and untainted.

Kambisi

Scombridæ

Migratory Habits.—The habits of this fish are very similar to those of the koli-koli.

A few are caught during June. They then go on increasing in numbers till September, during which month they reach their maximum. In October they begin to decrease, and go on decreasing till January. In February and March very few are to be found. In April and May there are none at all.

Breeding.—It is not known where they breed. The size of the roe is about that of millet. No young fish have been found in the vicinity of Lamu.

Haunts.—They frequent both shallow and deep water.

Bait and Methods of Capture.—When fishing with a hook and line the most acceptable bait to the kambisi is 'kamba' (prawns), 'dome' (octopus), and 'mkisi' (mullet). It is also caught in nets dragged to the shore between two canoes, and it is frequently to be found caught in the fish-traps set up in the creeks and inlets.

Tengesi

Barracuda

Migratory Habits.—This fish is said to come from the Arabian coast. They come south with the north-east monsoon, and a few of them may already be caught during November in the waters of Lamu. They increase in numbers up till January, when they reach their maximum on their southward journey. During the north-east monsoon they can be seen travelling in a southerly direction. They do not linger at all near the Lamu archipelago, and are only caught as they travel past. They decrease in numbers during February, and as soon as the monsoon begins to die down they turn round and can be seen travelling with their heads turned in a northerly direction. By the beginning of the rainy season—that is to say, in the first days of April, they have already entirely disappeared from the vicinity of Lamu, and are not to be seen again till the beginning of the next north-east monsoon. While travelling north, much fewer are to be seen than when they are going in a southerly direction.

Breeding.—It is not known where the tengesi breeds. The roe is generally slightly larger than millet. No young fish have been caught here.

Haunts.—This fish very rarely comes into the creeks and inlets of the coast, but keeps to the open sea.

Bait and Methods of Capture.—The tengesi is not common in the fish markets of the Lamu archipelago, as it is neither caught in nets nor in fish-traps. The only method of fishing for it here is by artificial bait consisting of a piece of white rag fixed on a hook and line and towed behind a fast-sailing dhow. The line used is about the thickness of a pencil. Sometimes a small white fish called ‘ dagaa ’ is put on the hook instead of the white rag.

Fulusi

Coryphæna sp. (Dolphin)

Migratory Habits.—This fish is only to be found in Tanaland waters towards the end of the north-east monsoon, during a period of about two months—that is, during February and

March. As soon as the rainy season begins they disappear from these waters.

Breeding.—It is not known where this fish breeds. The roe is very small indeed, not much bigger than a pin's head. No young fish have been caught here.

Haunts.—The fulusi does not come into the creeks and inlets of the coast, but generally keeps well out to sea. It may occasionally be seen near the coast in the vicinity of an open bay where the bottom is sandy and deep, and free from seaweed.

Bait and Methods of Capture.—Like the tengesi, the fulusi is not a common fish in Lamu waters. Owing to its generally keeping well out to sea, it is not caught in nets nor in fish-traps. It is only fished for with an artificial bait consisting of a white rag fixed on a hook and line towed behind a fast-sailing dhow. They are rarely found in the markets of the islands.

Nguru

King-fish (Scombridæ)

Migratory Habits.—The nguru is a common fish in Lamu waters, which it inhabits in more or less numbers all the year round. From April till October it is less frequently found, but in November it begins to increase in numbers till it reaches its maximum about the end of December. It then begins to decrease till March, when its numbers remain more or less constant till they begin to increase again in the following November.

Breeding.—It is not known where the nguru breeds. The roe is somewhat larger than the size of millet seed. No young are found in these waters.

Haunts.—This fish frequents the creeks and inlets as well as the high seas, where they are more often found, however, than in the creeks.

Bait and Methods of Capture.—It is caught in fish-traps, but not in nets. It is also fished for with a hook and line, the best bait being 'kamba' (prawns) and 'mkisi' (mullet). But it can be more successfully caught by an artificial bait consisting of the usual white rag fixed on a hook and line towed behind a fast-sailing dhow.

Mtumbu

Migratory Habits.—This fish is said not to migrate, but frequents the Tanaland waters in large numbers, comparatively to other game fish. It is most common in July and August.

Breeding.—It breeds on this coast, young fish being found in the creeks all the year round. Opinions of fishermen vary as to the time of year when the roe is largest. Some say the fish spawn at the end of one or other monsoon, while others say that spawning time is in January or February.

Haunts.—The younger fish keep to the creeks, while full-grown fish prefer the open sea.

Bait and Methods of Capture.—It is caught in fish-traps, nets, and with hook and line, the best bait being 'mkisi' (mullet), and 'dome' (octopus).

Mkisi

Mullet—used for bait

Migratory Habits.—This fish is said not to migrate from this coast, and are to be found here in plenty all the year round. According to information obtained from Arabs, it is not to be found in Arabian waters.

Haunts.—The mkisi rarely goes out to the open sea, but lives in the quiet waters of mangrove creeks. It prefers a muddy bottom to a sandy one.

Breeding.—Young fish are found in the vicinity of the Lamu archipelago. The roe is described as being the size of grains of sand. In some individuals the roe is white, and in others it has a reddish-brown tinge which is considered by Lamu fishermen to be a sign that the fish is in a full-blooded, healthy condition.

Bait and Methods of Capture.—The mkisi is not fished for here with hook and line, as it will not take the ordinary kinds of dead bait used by natives, who consequently look upon this fish as a vegetarian. Its food is believed to be weeds and other vegetable matter to be found round about the roots of mangrove trees.

It is fished for by means of nets and fish-traps. Another method is practised by night, and consists of lighting a straw fire in a canoe so as to produce a tall flame. Attracted by the light, the fish jump towards it and fall into the canoe.

Nyuna (or Una)

Scombridæ, a small silvery bait fish

Migratory Habits.—This fish is to be found all the year round in Lamu waters, but is more plentiful from March till November. They are said to be much more numerous in Arabian waters than here, but it is not known whether they actually migrate.

Haunts.—The nyuna lives in the open sea, but prefers land-locked bays with a sandy bottom—like Manda Bay, for instance.

Breeding.—It is not known if they breed here. The roe is extremely small, and is described as being like grains of sand. Lamu fishermen believe that they do not spawn at all, but that they fall from heaven with the rain, as they always become much more plentiful as soon as the rainy season begins in March.

Bait and Methods of Catching.—This fish is caught in nets, traps, and with a hook and line, the best bait being crab meat, sea slugs, and octopus meat.

A NATURAL HISTORY EXPEDITION THROUGH THE KEDONG VALLEY, B.E.A.

By A. Loveridge

The object of this trip was to collect the eggs of vultures and buzzards, which we were told nested in the rocky fastnesses of the Kedong Valley, an arid region lying almost due south of Lake Naivasha. The only data we had to go upon as to the right season to procure eggs was an account of the nesting of an augur buzzard, whose eggs hatched on August 22, and

information given by Mr. A. J. Klein, who had visited this region 'about the middle of August,' at which season there were apparently 'large young ones in the nests.'

July 15, 1915.—Rising about 5 A.M., I breakfasted, and then packed my bedding, &c., and started my boy Cumow off to the station as 7 A.M. I left at the same time myself for the Museum, where I filled a portmanteau with scalpels, preservatives for skinning, and all necessary materials for entomological collecting. At 7.30 Kinangozi—the Museum skinner—started with this bag to the station. Finishing off a few matters and straightening up occupied me for nearly half an hour longer, so that I arrived at the station exactly at 8 A.M. We were to travel in the guard's van of a goods train due to leave at 8.30, but, as a matter of fact, we did not get off till something after 9.30.

Very leisurely did the train move along, and I spent some time sitting on the step and watching the scenery, and at times one could well have jumped out and run alongside. I saw a fine black-backed jackal (*Canis mesomelas*) by a fence of the Government Veterinary Farm, Kabete. We did not get off at Kijabe, as originally planned, but arranged to be dropped ten miles further up by the track. It was a veritable 'No Man's Land' where we got out, and after wishing the guard good-bye, we did not see another man, white or black, for four days (except one native on the fourth). The soil was very sandy and scattered over with mimosa and thorn bushes; what little grass there was was dry and yellow.

Some two hundred yards away from the line we could see some Coke's hartebeest (*Alcelaphus Cokei kongoni*), and in following these up I came upon a very fine cast skin of a hissing sand snake (*Psammophis sibilans*). We marched for about two hours towards Lake Naivasha, and pitched camp some three miles south of it. After a cup of tea we followed up a big herd of kongoni near the camp, and my companion, Mr. A. G. Bush, shot one for the porters to eat; including the two gun-bearers, headman, and cook, there were thirty of these fellows to be provided for. We had to hurry back to reach camp before dark, and on the way I picked off two cicadas who were shrilling away on a shrub.

July 16, 1915.—Rose at 5.30; it was bitterly cold, being 7000 feet above sea-level (Snowdon is 3571). Breakfasted by the camp fire whilst our tents were being pulled down, and got away before 7 A.M. After going a few miles we were descending a hillside when my companion spotted a fishing eagle (*Pandion haliœtus*) down in the middle of a great plain that stretched away to the lake shore. It very soon saw us, and, rising on its great five-foot pinions, slowly flew in the direction of the lake. We watched it through the glasses, and apparently it pitched in a euphorbia tree half-way up a rocky cliff-like escarpment. Whilst the safari continued its way, we followed after the bird, and as we approached the tree I could make out a nest with apparently the bird on it. At the same time my companion fired at some rock hyrax (*Procavia Brucei maculata*) and killed two females. With two such loud reports going off almost immediately below its nest one would have expected the bird to leave—but no.

I climbed the escarpment till I was almost level with the huge nest, and the bird's head distinctly visible some thirty feet from where I stood. The tree was like a huge cactus, with pear-shaped leaves from which other pear-shaped leaves sprouted. With bits of earth I pelted the bird, and though one pellet fell on her back and another hit her on the head, she merely stood up in the nest. We both agreed that we had never known a bird sit so tight, and I was convinced that it must be an almost fledged young one; and so it turned out to be, as a little later we saw the parent birds soaring up in the blue nearly a mile away. We put up a big owl, probably *Bubo maculosus*, but failed to find any nest among the rocky crevices in the crags.

After this diversion we plodded on our way across many miles of grassland and thorny scrub. An interesting feature of these acacia bushes was that almost every dried black fruit had a hole below the pair of large white thorns, and if you attempted to reach a nest in the bush or brushed against it, out swarmed small ants from these holes and ran hither and thither with their acutely-pointed plump little abdomens jerking up and down; as soon as they had crowded on to one's sleeve or arm they commenced to bite fiercely. I am not

sure if I am correct in calling these growths 'fruits,' as they always appear to be hollow round balls about the size of an English horse chestnut.[1]

We came across lion's spoor and several remains of kills; also disturbed a jackal, which loped leisurely away. For the first time I saw eland (*Taurotragus Oryx Livingstonei*) in a wild state. This is the biggest of all the antelopes, and interesting experiments in domestication are being conducted at the Government Farm, Kabete. Zebra were abundant. Walking through a heathery-like vegetation nearly up to one's knees, I disturbed a francolin, and a moment later Mr. Bush started a cheetah (*Cynœlurus jubatus guttatus*) at a few yards' distance; it went bounding away, and was lost to sight amongst the rocks at the entrance of the gorge.

The cliffs forming the sides of the gorge were some two hundred feet high, and at its entrance the width must have been nearly half a mile. Camp was pitched under the shadow of the cliffs on the right at 12 A.M., and we were glad to escape from the fierce heat of the noonday sun. Swifts, swallows, and martins of several species had their nests here, the swifts in crevices, whilst the swallows and martins had plastered theirs to the cliff-face, sometimes in clumps of twenty or more. I also watched a pair of sprees (rock starlings) coming and going from a nest hole. We could hear the cries of young from many of the nests, which was a bad omen for the success of our expedition.

Later in the afternoon we went for a stroll, and collected a wheatear (*Saxicola pleschanka*), a spree (*Spreo* sp.), and a sunbird (*Cinnyris* sp.), all new to the Museum collection. A pair of secretary birds (*Serpentarius secretarius*) were stalking about the plain in the middle of the gorge, but were far too wary to allow anyone to come within range. As the shades of evening drew in, thousands upon thousands of swifts shot screaming through the air, parties of five or six would dive past your head and startle you with the sound of the air whistling through their feathers. It was whilst busily engaged

[1] These hollow balls are the swollen bases (galls) of the young thorns of *Acacia fistulosa*, and are occupied by ants after their abandonment by the gall-fly.

in lying on my back looking up at them that I witnessed a never-to-be-forgotten sight. A hawk shot out from the shelter of the cliff in pursuit of a swift which sought security by soaring up into a flock, many thousand strong, and dodging amongst them. Never for a moment did the hawk lose sight of its prey; hither and thither amongst that mighty host they sped, and several times the swift only saved itself from the pursuing beak by a sudden doubling. Whilst this was going on, the swifts from all around were coming up, till such a mighty host of birds I never saw in my life; the sound of their wings was like that of distant waves breaking on the shore, and the air was full of their whistlings.

How long the pursuit lasted I cannot say, as I was too intent on watching it through, but finally the hawk gave up, and slowly sailed off to its niche in the cliff-face with a score or two of shrieking swifts in attendance.

July 17, 1915.—Whilst the skinners were preparing the hyrax and birds, I strolled off and shot two male and a female bee-eater (*Merops bullockoides*). These birds hover in the air catching insects just like a flycatcher; they also cling to the face of a cliff as a swift does. Immediately after lunch we started off through the gorge to a place where we could get water, the present camp being four miles from the nearest. The cliffs on our right became higher and higher, till I am sure they were at least three times as high as the highest points between Penarth and Lavernock. Sitting on a rock at the base of this towering cliff was a young eagle (*Aquila rapax*), and another was on a tree a few yards off. The former fell dead with a 0·22 bullet through the heart, and one of the boys clambered up and fetched it down.

I disturbed a duiker buck in some scrub, and we saw a lot of zebra (*Equus Burchelli Granti*) and kongoni. We came across some lion spoor and a lot of leopard till after several hours' marching we descended about a hundred feet down a rocky watercourse into a still narrower gorge which was crammed with vegetation, differing in this respect from the part we had just left.

While camp was being pitched here I took a stroll on to try and get one of the lead-coloured pigeons which were very

common, but of which no representative existed in the Museum collection. The sky grew very black, and gusts of wind whirled through the gorge, betokening a coming storm, so I hastened back to camp, getting there just before the first heavy drops began to fall. On the way I heard the 'chacma, chacma,' cry of a baboon (*Papio ibeanus*), and looking up saw a great beast sitting on a boulder weighing half a ton, on the very brink of a 200-feet precipice. It looked very weird against the lowering sky.

July 18, 1915.—Being Sunday, we remained in camp, and about noon the heat was terrific, being retained and reflected by the masses of rock on either side, for at this spot the gorge was only a hundred feet wide from cliff to cliff. Beside the camp was a little trickle of a stream of a rusty-red colour from the sap of acacia bark which it absorbed on its way. There were a lot of very innocent and Musca-like flies which were armed with a sucking proboscis and were as painful in their operations as English horse-flies.

About 11 A.M. we strolled down to where the gorge opened out about a quarter of a mile below camp, and here we came upon a clear-as-crystal streamlet which we agreed was far better for making tea and porridge from than the acacia-bark mixture.

We followed it up, and presently came to the remains of an ox lying in it. 'Bass' (spelt 'bassi'), which is the native way of saying ''nuff said.' This second stream issued from another narrow gorge which was as tropical in appearance as one could wish, and we proceeded up it for a little way. Mr. Bush, noticing steam arising from the stream, put his hand in and found the water as hot as he could bear and tracking the stream to its source, found the water coming out of the spring almost boiling. In the more temperate part there was a brilliant green conferva growing in it of that shade which one associates with the trees in 'Noah's Arks.'

July 19, 1915.—We were astir at dawn and on the march by six o'clock. As we wended our way down the sandy-gravelly dry river bed, bounded on either side by the limestone cliffs afar off, I discerned what I took to be a column of smoke from somebody's camp-fire. As we got nearer it proved to be

a column of steam nearly a hundred feet high arising from the lava, and as we got near, the water below could be heard boiling, the noise being like to the rumbling of a train and distinct for three hundred yards away or more. We climbed the slope to it, but all that one could see was the steam pouring up through the fissure, whilst within a hundred yards were five smaller jets and a score or two of very small ones arising from the ground. The lava all about was very sulphureous. Mr. Bush opined that the crust must be very thin for so many small jets to have worked their way out, and considered it an undesirable place to be standing about on.

In my opinion, the whole scenery was very like the pictures one sees of the Yellowstone National Park, and the only thing lacking appeared to be cascades of water and the 'big trees.' It is probable that at one time this gorge served as an outlet to Lake Naivasha. Hornblende lay about in lumps in considerable quantities.

Further on we came across the mountainous droppings of a rhinoceros, and saw where it had been tearing up the ground with its horn and smashing up the shrubs and small trees in some exuberant fury. Plenty of leopard tracks, and we were afterwards informed that this gorge contains the largest examples in the country.

As we proceeded, vultures became commoner, circling in the sky at a great height or sitting in the trees on the brink of the precipice, and then to our left we came upon the place we sought, a great cliff from which there flapped away numbers of buzzards and nigh on a hundred vultures; though the cliffs were liberally white-washed, we could not distinguish any nests, and as we were certain that these would now hold large young ones, if anything at all, we held on our way instead of going over to them.

It was now about eight o'clock, and we were clear of the gorge when a native rose up from behind a bush and handed a note to Mr. Bush inviting us to partake of breakfast with a surveyor named Mr. Gemmell; this we gladly decided to accept. The man pointed in a certain direction, and said the camp was just over there; after half an hour's hard walking he was again inquired of, and the cheering information given

that it was quite close by, and so on till we reached it at 9 A.M.

Breakfast over, we lay around till 11.30, when Mr. Gemmell's mule turned up, which was very kindly placed at Mr. Bush's disposal for a week, as his feet were badly blistered. Our host told us that two nights before, when half a mile from camp, he came upon a troop of ten lions and three cubs; being armed with nothing but a shot-gun, he remained quiet, and fortunately they did not molest him. He was at this time engaged in marking out the boundary line of the Masai Reserve, to which he conducted us. The boundary is marked by clearing all shrubs and trees for a width of about twenty feet, which gives it the appearance of a ride in a fir copse at home, only in this case it stretched away almost as far as the eye could see. Hour after hour we plodded along this through the Barra-barra, a famous lion country where Paul Rainey recently got seven or eight out of a troop of nine in one day. On reaching the survey beacon we turned off along a native track which passed through a variety of country. On some rocks I shot a brilliant Agama lizard whose head was coloured a rich brick-red, and the body, more particularly underneath, a vivid ultramarine blue.

In some trees near an empty watercourse I secured a pair of bee-eaters (*Merops pusillus*), not so large as the species inhabiting the gorge, but, if possible, of more brilliant colouring, consisting of bright green, blue, yellow, and black. Also shot a glossy starling (*Lamprocolius sycobius*), a larger bird than the English species, and its plumage is of a most metallic electric blue. After walking for five miles across a plain which was like walking through an English hayfield, we reached the house of Mr. ——, where we were very hospitably entertained to tea and dinner. Next morning they were off to a camp near the little crater on Mount Siswa, and we were regaled with glowing accounts of the abundance of game, particularly buffalo, so we decided to accept their invitation to accompany them and return to our camp in the evening.

July 20, 1915.—Started about eight. On the way up I visited their water-supply—a pot-hole in the dry and rocky river-bed. As in many pot-holes, the sides were undercut, and

during the drought of last December thirteen buffalo (*Bos caffer Radcliffei*) fell in and died a miserable death, trampling on each other. No one could approach the place, for as long as they were alive the remainder of the herd kept guard over them.

For an hour and a half we marched up the rocky slopes forming the sides of the old volcano, and for another hour we trekked across a grassy plain leading into the mouth of the crater, which was many miles across. The smaller crater we could see half a day away in one corner of the larger crater. It was full of fine trees and vegetation. The sides, we were told, are very precipitous, being 300 feet sheer in places, and it is said that no one can get into it—hence the title of the 'Lost Continent' which it has been dubbed. A mile inside the big crater we halted and, bidding our 'friends' 'Good-bye,' turned back, sadder, wiser, and most certainly footsorer. We mutually agreed that never before was such a 'had' or 'take in.' To drag poor blister-footed wayfarers up the mountain to look on a great bare grassy plain whilst incomparably superior scenery was below made it difficult to express our feelings.

While Mr. Bush was off after a kongoni, I started back a short cut with my boy, and crossed half a dozen dry river-beds full of vegetation. In the sand I came upon numbers of lion tracks and very fresh traces of rhino. Camp was reached at 1 P.M. Later in the day, when it was cooler, we sallied out near camp with some beaters, and I shot a bare-throated spur-fowl on the wing. This bird (*Pternistes infuscatus*) is larger than a partridge, and the bare skin of the throat is brilliant yellow shading into crimson nearer the beak.

Mr. Bush shot a fine bustard (*Eupodotis maculipennis*) both of which were made up for the Museum.

July 21, 1915.—Up at 4.30. At this time of day the temperature is bitterly cold owing to the altitude. About 5.20 the first flush of dawn appeared in the east, and ten minutes later we were just able to see, so started off. For the first mile I rode the mule, but as she fell through mole-holes at every few yards, I decided on my own feet. As it grew light we heard a most weird and human-like bleating which our boys said was made by the newly-dropped young of Thompson's gazelle (*Gazella Thomsoni*). There were great herds of Grant's gazelles

(*G. Granti*) about too, and my companion shot a buck of one of these for its meat. Zebras appeared very tame, and several times allowed us to come up within thirty yards of them before making off. Many of them were accompanied by their young.

Near Mount Margaret Mr. Bush shot a Stanley bustard (*Otis caffra*), a very fine bird slightly larger than a turkey. We also picked up a few lizards along the path, and I glimpsed a hissing sand snake disappearing into its hole, the first snake seen on the trip. At noon we reached the Kedong River, a small affair just over one's knees. Here I halted, having done nineteen miles without a stop except to bag an occasional specimen. I paddled about till the safari caught up and then on again to Mr. Bowker's farm, a mile and a half away. We were very hospitably received and entertained for the rest of the day.

Camp was pitched under a fig-tree beside a water-furrow close to the house. Monotony was kept at bay by a bevy of domesticated ostriches which were on the alert to pick up what came their way; one of them seized the body of a bird just removed from its skin by my boy. About noon a swarm of locusts arrived which had been haunting the neighbourhood for the past three weeks; they took five hours to pass over—it was like a snowstorm in many ways, the air being all a-flutter with them.

After tea a friend of the family took me down to see a curious phenomenon in the shape of a poison hole; the gas came from a crevice in the rock, and was so heavy that it did not rise two feet above the ground; it felt quite hot about my feet and legs. The gas, whatever it is, must be pretty strong, for there were the bones of a buffalo that had lain down (probably to sleep) and died. Quite recently they picked up a fine horned owl at the spot, and dead snakes were found fairly often. I saw hundreds of butterflies dead in the grass that had fallen victims to the fumes. Saw a wild pig that made off very quickly. Hurried back to the house in the gathering dusk. Turned in about 11 P.M., after a creditably long day in which I had walked twenty-three, if not twenty-five, miles.

Next morning we climbed up the steep path for about three miles through the woods to Escarpment Station. There were

many fine butterflies about and at least five species of *Papilio*; but the dominant insects were the locusts, and I trod on many hundreds as they crawled on the path. The bushes and trees were loaded down with them, for it is about the biggest swarm ever known in the Protectorate. At one time we thought the train would come to a standstill, as it slipped so on their bodies, but a boy was sent along in front of the engine to brush them off the track. The air as far as the eye could see was simply alive with them.

NOTES

NOTES ON THE WA-SEGEJU

By Capt. T. A. Dickson

The Wa-Segeju originally inhabited an area north of the Tana river known as Shingwaya, and were therefore neighbours of the Wa-Digo.

In consequence, however, of the constant raids of the Wa-Galla, the Wa-Segeju, under the leadership of Mwamsimburi, trekked southwards and settled at Ormuz (Pongwe) in Vanga District.

No settlements were made *en route*, and the migration is stated to have been prior to that of the Wa-Digo.

The original Kisegeju is stated to be more akin to Ki-Galla than Ki-Digo, and many Galla proverbs are used by the Wa-Segeju. There seems, however, to be no other remaining traces of resemblance; the features of the Segeju have more of the distinctive characteristics of the Wa-Galla.

On the other hand, their customs are quite distinct from the Wa-Digo. Inheritance is from father to children, and property is equally divided. Land is communal, cultivation giving right to individual tenure.

The clan system is, or rather was, the basis of tribal constitution.

The chief, or leader, is always chosen from the clan of Mwakamathi.

The following is the dynasty as far as I can trace it:—

Mwamsimburi	Makaroi
Mwakami	Mwakita
Kavata	Mwakavi
Mwanzara	Buhuri

This, however, would only make Mwamsimburi a contemporary of the first Kubo of the Wa-Digo, and I think further research will probably bring to light either previous chiefs or ones who have been omitted in the list given me.

A BIRD COLLECTION FROM LAMU

Editor

The Society has, through the generosity of Major Meinertzhagen, come into possession of a large collection of birds from the coast.

Major Meinertzhagen was desirous of obtaining evidence regarding the migrants which pass up and down the coast annually, and approached the Society with a proposal to despatch the Acting Curator, Mr Allen Turner, to Lamu to collect birds in the spring of this year ; the Committee agreed, and Mr. Allen Turner left Nairobi for Mombasa on March 19, 1916. Unfortunately, upon his arrival at Mombasa no coasting boat was available at the time, so Mr. Turner was delayed there till March 30, when he proceeded to Lamu by a sailing dhow. The delay was unfortunate, as the collector missed the majority of the migrating species, but the Society's collections have been enriched by some 850 specimens, and great credit is due to the assiduous work of Mr. Turner. Mr. Turner left Lamu on June 9, and returned to Mombasa and Nairobi.

Thanks are also due to Mr. Whitton of Lamu for the assistance he rendered to Mr. Turner in lending his boat and for his general kindness to Mr. Turner.

A systematic list with notes has been prepared by Dr. van Someren, and will be published in the next issue of the Journal.

Owing to the rainy season being on, Mr. Turner had considerable trouble in preserving the specimens, as decomposition sets in with extraordinary rapidity in the warm steamy atmosphere of the coast during the rainy season.

Mr. Turner in his notes describes the visit of four lions to Manda Island, where they were attacking the natives' cattle. These animals must have swum or waded over from the mainland at low tide. The natives stated that the last occasion on which lions had visited Manda was seven years ago.

Mr. Turner went to Manda with a party to hunt them, as they were taking cattle. He, however, met with no success.

ALBINISM IN EAST AFRICA

By S. L. Hinde

Having seen Mr. C. M. Dobbs' note, 'A White Kavirondo,' in the Journal of March 1916, your readers may be interested to know that I think as large, and probably a larger, percentage of Albinos are born to negro parents in tropical Africa than are born to European parents in Europe. These children are seldom seen by Europeans, as many tribes destroy them at or soon after birth, and those that are allowed to survive are difficult to rear, being without protective pigment, even in the iris; this, owing to the blood-vessels being unscreened, causes the well-known pink or red eyes in Albinos.

I have not my notes available, but, writing from memory, I saw one Albino child about six years old near Accra (West Coast) in 1891, and I think I saw three at least in the Congo Free State. In East Africa I saw one Albino 'Mkikuyu about four years old, near Old Fort Smith in 1896. The only adult I have seen was a 'Mkamba, a well-known character near Kitui Station, who I believe in the early days of the Protectorate was sentenced to imprisonment by Mr. C. R. W. Lane, then collector of Kitui, his crime being—dressing in khaki uniform, pretending to be a European official and blackmailing his fellow tribesmen. A 'Mkikuyu, of whom, with his parents,

I have photographs, I saw when he was about six months old, in 1903 at Karuri's village. This child was again seen by me some three years afterwards.

In Kutu's country near the Ziba, in 1906, I saw an Albino lad about ten years old.

All these suffered from exposure to the sun's actinic rays more than a European would, owing to the total absence of pigment in the tissues, and the inability to produce a protective pigmentation in the skin of exposed parts, such as takes place in normal persons whether white or coloured.

These poor people were all suffering from sores and scabs on exposed surfaces. As far as I remember, in each case the hair was a very pale straw colour, and not dead white as is usually seen in European Albinos.

NATURAL HISTORY NOTES FROM BRITISH EAST AFRICA

By A. Loveridge

May 24.—Spent the day at Kabete. The most interesting capture was a bat, which was hanging head downwards from an old pigeon's nest, situated in a eucalyptus tree about forty feet from the ground. As the tree was too slender I swarmed up an adjacent one, which I expected to bend over every minute with my weight. I carried my net over my head and easily reached across and bagged the animal, but it bit and tore a large hole in my net. I chloroformed the creature on reaching home, and it measured 22 inches from wing to wing.

Some of the nests I found were as follows: African pied wagtail (*Motacilla vidua*) sitting on three olive-green eggs in a bush overhanging a waterfall. This bird is very like the English pied, but the situation and eggs are very different. Reichenow's weaver (*Helerhypantes reichenowi*) sitting on three eggs, nest in hedge. I was attracted to this nest by the cries of the birds as I was cycling past. The cause of the commotion was a lark-heeled cuckoo (*Centropus superciliosus*), which was

hopping about in the hedge-bottom in a very guilty fashion. This cuckoo is as large as a kestrel and has a very hawk-like appearance, they are locally called bush crows. I looked up a book of South African birds, and find that its Cape representative is credited with building a nest for, and raising its own young.

In an old weaver bird's nest in a very thorny shrub, I found five eggs of the sociable weaver-finch (*Spermestes scutatus*); two eggs were perfectly fresh, two were perfectly bad, so much so that they exploded on being pricked with a pin; the fifth was empty with a very small hole in its side, such as might have been made by a bird's claw, and the contents removed by ants. The eggs are the size of a tom-tit's, but oval, neither pole being larger than the other; colour pure-white, but tinted pink by the presence of the yolk before being blown. The bird is no larger than one's thumb and is one of a group of small weavers which a friend aptly terms 'animated-plums,' many of them being plum-coloured. The species under consideration has a black cap, and several lay in one nest.

Egg-collecting here is extremely interesting, as you have to wait and watch for the bird and then identify it from notes or memory from the collection of skins in the Museum. There are no books on either the birds or eggs of this Protectorate.

I found about ten nests containing eggs (four, five, or six in a nest) in a black wattle plantation. The nests are like those of very untidy wrens and all built of one kind of grass still green. My host had a splendid show of asters, about which hovered a host of handsome clearwing humming-bird hawk-moths; many of the blooms had the centres eaten away by large chafer beetles; there were also a number of small ones of a bright green.

May 29.—In the long grass on the plains I found three nests of the red-necked weaver (*C. laticauda*) each with a clutch of three eggs. Three seems to be the favourite number with the weavers. I have just noticed in Pouchet's 'Marvels of the Universe' a full-page illustration of the nest of the African sociable weaver, in the foreground are two deer, apparently elk, drinking from a swamp. They must have been imported for artistic reasons. A similar howler is in a

magazine article which I cut out recently. The article is entitled ' Fear in Animals, ' and we read that in the great forest fires they lose all fear of one another—elephants, snakes, lions, tigers, antelopes, flee side by side from the common enemy. There was also a full-page illustration of the flight, with a lion bounding majestically along accompanied by a trumpeting elephant, a tiger slouching through the undergrowth, with both deer and antelope bringing up the rear !

June 1.—On January 13 I remarked on an apparently old nest which I poked off a branch, when a fresh egg like a shrike's fell to the ground. To-day I was again passing the tree, and turned aside to take a look into it. On the same branch was an almost identical old nest with a shrike (*Lanius humeralis*) sitting tight on four eggs. At every season of the year, as far as I can speak, I have seen adult shrike with newly-fledged nestling clamouring for food on the telegraph wires or fences, so they must breed all the year round. They certainly have abundant thorns for their larders, and I have come across huge caterpillars impaled by them.

June 3.—Being Empire Day, I cycled out in my own company to Ngong Forest, about ten miles from Nairobi. Though I collected a lot of insect life, there is little to report of interest.

About the tree-tops were some magnificent swallowtails (*Papilio cenea*) &c., and from 2 P.M. till 3.45 P.M. I walked up and down the forest path trying to catch them, as occasionally one would flash like a meteor into some sun-lit glade or zigzag along the path about six feet above one's head. At a quarter to four I caught the first, and as I laid the net on the path and knelt to transfer it to a collecting envelope, a shadow fell upon me, and I realised that another swallowtail had paused in its flight to hover over me. This suggested an idea, and removing my beautiful prize from its envelope, I laid it with outspread wings on a near-by shrub. I had scarcely time to step back before seven or eight of these large butterflies were fluttering round their dead comrade, and within *five minutes* I had captured four more. I tried the same bait at different spots, and always with the same result, though never more than two came at the same time.

Some of the cicadas were peculiar. I shook a sapling and something fell in the grass which, after taking a look at it, I was satisfied was nothing but a piece of lichen. Later, elsewhere I heard a sudden chirp, and looking down saw a similar piece of lichen animatedly endeavouring to escape between the grass stalks; on capturing, it proved to be a cicada. The noise they make in the trees is quite deafening.

On May 29, and again to-day, I came across some oil-beetles with a scarlet patch upon them feeding on the Cucumis plants. There were about eight to a plant on both days, and none on the surrounding plants. The interesting thing was that the large females were being followed up and down leaf or stem by smaller males, who stroked them from the elytra to the end of the abdomen with their antennæ. Both antennæ would be raised simultaneously and stroked caressingly. It was almost ridiculous to see the larger beetles walking off or feeding with their devoted attendant.

June 5.—Out on the plains I found some twenty-five eggs, but will only mention that of *Quelea cardinalis,* a handsome little weaver finch with a rosy throat and forebreast. This nest is built in the low Cucumis plants, and two or three of the prickly leaves are drawn together, one sheltering it from above and two forming a cup to hold the open nest. In one nest there were three eggs of a dirty olive green colour, and in the second nest a similar but deserted egg.

June 9.—On May 17 I got a fellow-boarder to shoot his dog, a large brown retriever, which was raw and sore with ticks and mange. Visiting the site of the execution to-day, nothing but bones remained and a trace of fur, amongst which were some repulsive beetles like the English Silpha, who, on being disturbed, tuck up their heads and legs very compactly. What I wished to remark on, however, was that of the score of specimens that I took, more than half had some part of their limbs missing. The *Dermestes vulpinus* mentioned previously were also present, and rolled on their backs as described.

June 26.—Receiving an invitation to visit the Mission at Kijabe, I caught the night train yesterday, and arrived at 1.45 A.M. Kijabe is 6990 feet above sea level, therefore nearly 1500 feet higher than Nairobi. At the back of the station is a long

range of heavily wooded mountains, whose tops are shrouded in thick fog till mid-day, when it clears for a few hours. At 7 A.M. I walked about four miles along and up this hillside to the Mission. Though I spent all the hours of daylight from 9 A.M. till 6 P.M. rambling about collecting, I got very little, as the weather was so overcast and raw.

Of animals I saw none save a mouse, which left its nest of grass in a bush; this contained a little blind young one. I found two similar nests empty. Out of a good many birds' nests examined, only two contained anything; one of these was that of a sun-bird, slightly larger than an egg-cup and beautifully hung, as is their custom, to the drooping extremity of a branch; it held two young. The other nest was a weaver finch's, in structure like a wren's, and built in a young fir about fifteen feet from the ground. As I looked into it, the sitting bird flew out, nearly striking me in the face; its strong little beak was a brilliant red, and the owner of the beak no larger than a plum.

There were a great number of sun-birds (*Drepanorhynchus Reichenowi*) on the lower ground which are never seen at Nairobi. The general colour is a velvety black, with a very long and slender pointed tail of an old-gold colour, and a splash of the same showing on each closed wing. These clung to the stems of a plant bearing a circlet of red tube-like flowerlets, and, rapidly running round, dived their three-inch long curved beaks into these inflorescences and extracted the nectar. I should have mentioned that the birds are about five inches long, and that the sun-birds or honey-suckers (as they are called locally) are very similar in appearance and habits to the humming-birds of America.

June 27.—I was directed to a path which leads up the mountain, but as I failed to find it, I struck up through the forest, following game trails whenever possible, which often necessitated going on all fours through the undergrowth. After ascending 500 feet, I fortunately came out on to the path, and it was as well, for shortly after I entered the mist or fog-belt, everything was dripping, including the atmosphere, for the fog was condensing and drops falling from it. The fog blew in wraiths about me; at one moment I could see a hundred yards ahead, and the next scarcely ten. At one time I could see a hornbill sitting on the dead limb of a giant tree, probably blasted by lightning;

even as I looked, a bank of fog rolled between and completely blotted it from view.

A tremendous chatter, like that in the parrot house at the Zoo, announced to me that a large flock of parrots were in the vicinity, so I wended my way in the direction of a clump of very tall trees whence the cries came. I could just make out the birds, many of them swinging head downwards to reach the bunches of berries on which they were feasting. Small flocks of four or five would leave the tree and circle round like pigeons before again alighting. The light was so bad that, though I was directly under them, I only saw the colour on one bird which came very close. The head was scarlet and the body green, which I think places it as *Poecephalus massaicus*, but it is doubtful. This was the first time I had seen parrots in a wild state.

I found the only other path down, and, on reaching lower levels, found the sun shining cheerfully. When I reached the house I found my host just beginning to think I had lost the way, which would have been extremely easy. In clearing forest a native disturbed and killed a fine female puff adder (*Bitis arietans*) measuring 3 feet 6½ inches. As I came on the scene shortly after and the specimen was undamaged, I carried it off. The only other reptile seen was the two-lined skink, of which I saw several.

With the exception of cicadas, insects were scarce; these, however, were very abundant and made a terrific din. As mentioned before, they harmonise in the most wonderful manner with the bark of the wild 'olive,' which is rugged and lichen-covered. They are very hard to catch, and have to be stalked most elaborately.

Another common insect was a large oil-beetle with red blotches on the elytra; unfortunately these fade when the creature is dead. I found them eating out the bases of some papilionaceous blossoms to get at the nectar; they were also common on roses. In a bush was the papery-muddy nest of an ant, into which I stuck my stick. The way the creatures swarmed out was a caution to behold, and within a few seconds or about a minute every leaf was a-quiver with them. On the previous day I must have brushed against some foliage, for I

found a score of the same species on my arm biting quite painfully, their little abdomens cocked at right angles to, or well over the thorax. Took about twenty species of butterflies.

July 2.—Whilst walking through some grass near the Scotch Church, Nairobi, I heard something rustling in the grass behind me, and, on looking round, half expected to see a snake. Apparently a brown animal, which I took to be a rat, was jumping up and down in the grass, and I caught it, when it really proved to be a harlequin quail (*Coturnix delagorguei*) that had sat so close that it had allowed me to tread upon it, badly injuring the head.

July 3.—Six porcupines (*Hystrix galeata*) have recently been killed on Jack Tate's estate at Muthaiga. They do a great deal of harm, eating quantities of maize cobs, which they obtain by gnawing through the stem till the plant falls. Whilst visiting there to-day, the bull-terrier came in bristling with quills, blood running from its right shoulder, and lame in that leg. It was therefore decided to unearth the offender, and four kerosene tins of disinfectant were prepared and poured down its hole at one entrance, but it did not bolt, so the hole was blocked at both entrances and a dozen natives sent into the thick scrub behind to beat it out, while Mrs. Tate waited with the gun.

After a wait of nearly twenty minutes there was a grunt and a rush through the undergrowth, and the next moment the beast dived into its hole, whilst the two dogs who were at its heel tumbled in on top. The porcupine is a much bigger beast than I imagined, and is not unlike a half-grown pig when skinned. There was a tremendous pandemonium as the two big dogs and the quills tumbled about in the pit made by the blocked-up earth. In less time than it takes to relate, the porcupine scrambled out and made through the cover, and we in pursuit; but to make a long account short, it got away in the end, after we had followed it up and down through the tanglewood and filled my stockings with grass seeds.

July 13.—When out collecting with one of the boys on the plains to-day, I heard him call out the welcome and familiar words 'Nyoka, Bwana.' He was some way in advance of me, and so I hurried forward, dropping my gun in the grass and taking my snake-stick from him, expecting to see one of the

small snakes of which we had seen several during the preceding day. There was, however, nothing to be seen in the direction in which he pointed, but the next minute I noticed a brown streak going full speed in the direction of a termite hill and about twenty feet from where I stood. I recognised in it immediately a very large spitting cobra, not far short of five feet if any.

Running after it, I struck it a blow on the end of its tail to check its career, hoping if possible to catch it alive; it did a half-turn and so did I, but almost without a pause it continued its course, and I followed, striking it on the back and, knowing what to expect, turned round on my heel presenting my back to the enemy, and next moment received a spray of venom all over my coat. In turning, I caught a glimpse of the cobra swinging round and erecting three feet of its body, swaying with spread hood; it was a very fine sight and one I would not readily have missed. The moment it had spat I chased it again, but it was almost on to the heap, and the next moment vanished down a hole. I returned and searched the heap an hour later, but no sign.

At mid-day next day I was off to the heap, provided with a pair of goggles. I should perhaps say that this termite's heap had a diameter of about twenty feet and was overgrown with weeds and grass as is usual to a height of two feet. Well, I circled the heap and walked all over it, and never a sign of the snake, which I supposed was taking a day in bed after yesterday's excitement. I had given up all hope of seeing it and was standing by the side of the heap with the grass above my knees, when I fancied I heard a rustle—all the grass was a-rustle with the breeze, however, but just in case . . . I casually struck the ground near me with my stick and listened . . . silence. I next tried about a yard almost in front of me, scarcely expecting any answer, but the effect was like pressing an electric-light button, for swiftly and suddenly up shot that blessed reptile, swaying its hood (being on the side) on a level with my chest and scarce a yard from my face. My goggles, which were on my chin, were over my eyes in a jiffy, and I whacked the snake on the side a few inches below the hood with my stick.

It appeared to fall over the stick, and I tried to heave it

off the hillock and pull the stick towards me; this only resulted in the fork being pulled out of the ferrule and the snake dropping into the long grass and down its hole, leaving me with my legs all a-shake.

August 18.—Someone drew my attention this morning to the baboons opposite the bungalow. Though it was about 8.30 and a fair amount of traffic was passing along the road, they had come out of the forest and were rooting about with the fowls among the native dome-shaped grass huts (natives being absent) within 200 yards of the bungalow. One old fellow seemed very busy stuffing handfuls of something into his mouth. I walked quietly across to him, with a galvanised iron shed intercepting his view of me, till I was within twenty feet. He then looked up, gave a bark, and appeared to canter away—in fact it gave very much the impression of a big mastiff bounding off. He only went a short way off and joined two others which had escaped my notice, and the three of them swung up into a small tree as far as the first fork, about eight feet from the ground and fifty yards from where I was standing. Numbers of others acted in a similar manner, instead of making off for the great forest trees as they usually do. I do not understand why they should be so exceptionally bold to-day.

Returning home at dusk this evening, in a hurry to be in before dark, a motor-cycle overtook me, and almost simultaneously a snake, which was evidently about to cross the road, suddenly recoiled from my front wheel and, turning, fled up the bank into the waste grass-land bordering the road. Pulling up suddenly, my rifle came over my shoulder and fouled my legs for an instant; but losing no time, I pursued the snake into the grass, and recognised it as a large female of the brown house-snake (*Boodon lineatus*), but lest I had made a mistake and it should prove to be a venomous species, I planted my foot on its tail before proceeding to pick it up. Then I grabbed it by the neck, but, contrary to my expectations, it was very gentle, not attempting to bite though naturally attempting to free itself. The bungalow being less than fifty yards away, I carried it straight in. Having had some trouble with the boys, who had been very dilatory in preparing my bath of late, I walked out to where four of them were sitting chatting round the

fire, and asked whether the bath was ready. On receiving the usual reply ' Bardo ' (in a little while), I told them to hurry up or I would give them a snake, and suddenly produced this one from behind my back. Instant commotion ensued with the overturning of boxes (which served them as seats), and with fezs grasped tightly in their fists, two were sprinting off up the path, the other two were peeping round the corner of their shed, and I walked back to the house. The bath was ready in ten minutes.

August 20.—During the night we had a heavy shower of rain, the first for several weeks past. Cycling into Nairobi, I came across a procession of ants crossing the road in single file, most of them carrying eggs or pupæ. In between the bearers, after every three or four, was a soldier, for all the world like a human *safari* party of a few years ago crossing the plains of British East Africa, when the hostile Masai were a power in the land. No doubt the rain had flooded out these little people from some ill-chosen site of a nest.

Returning home at dusk this evening, the same bike and side-car passed me as on Wednesday, and in doing so, ran over a similar large female brown house-snake a few yards in front of me. I did not know the creature had been run over till I seized it and got my hands all gory from the blood it was passing; there was no external trace of injury, but as the blood evidenced it was badly hurt internally, I chloroformed it immediately on getting in. It was very savage on being caught, and chewed away at my finger whilst I was endeavouring to disengage its tail, which it had entwined around my spokes. The muscular energy of dead snakes is extraordinary. Chloroforming one of this species to death the other day, I laid it on the table, and, after making an incision in the throat and another near the tail, I drew out the whole of its internal organs—lungs, alimentary canal, everything. On my right-hand side there lay the viscera with the heart beating manfully away, when suddenly the skin and skeleton—for it was nothing more—started to wriggle and twist in the most gruesome fashion. I was glad that I was a person of temperate habits, otherwise I should have had a bad fright.

August 21.—Cycled about five miles out to Jolleys' shamba

(farm). Saw one of the ordinary squirrels (*Paraxerus jacksoni capitis*) run up a tree. This is the third I have seen in eight months. Two green water-snakes were entwined among the foliage of bushes overhanging the stream. They harmonise with their environment in the most wonderful manner, and may be compared with the Asiatic green whip-snake (*Passerita mycterizans*) of similar habits. The latter, however, is poisonous, while the East African green snake (*Chlorophis neglectus*) is harmless. They were so extremely agile that I only succeeded in catching one, and it bit sufficiently hard to draw blood. On my return I strolled about on some waste land near the bungalow, where the grass was knee-deep, and here picked up a short-snouted sand-snake (*Psammophis brevirostris*) which was meandering about. In size it is about the same as an English grass-snake, and very prettily striped; it is slightly venomous, belonging to the back-fanged group. They must be fairly common just now, as I picked up two in the road last week.

Frogs were very abundant by the stream at the shamba. A noteworthy feature was a swarm of brilliant blue beetles of small size. A patch of herbage ten feet in diameter was alive with them, and they were flying about; there must have been several thousands. Three times I closed my killing-bottle over clusters of them on the flower-heads, and in so doing took 256 of the little creatures. About a dozen were claret colour, and I surmised these were males; one was purple.

August 25.—Yesterday I caught a large weevil on the path, which it matched to perfection; it had numerous pyramid-like lumps all over its back (thorax and elytra). On being touched it became rigid, and I carried it into the bungalow on a book and deposited it on the table, lying on its back; at the same time I looked at the clock. For seven minutes it remained perfectly rigid, with legs extended to the full. Usually, when beetles sham death, they draw them up close. This beast had a wonderful vitality. I left him in the killing-bottle over night, and set it by gumming on a card the next morning. The bottle was strong enough to kill other insects quite quickly. In the evening that beetle was rambling about the table. I put him back for a day and a night and

re-set him, afterwards placing the card in a store box. A week later, on opening the box, there he was walking about, and had not touched another specimen. I felt very sorry for him, though the gum was so thin it was easy to free himself. The third time I made sure of him and gave it a week.

The flower beds, sides of paths, &c., just now are adorned with a number of little pits like inverted cones. I found it a most interesting occupation dropping ants into them and watching the ant-lion firing jets of fine soil at the poor ant as it endeavoured to climb the sides of its prison. After being rolled down a couple of times, one catches a glimpse of a pair of jaws in the bottom of the pit; these seize the ant by a leg, and it is drawn down into its living tomb. So abundant are these traps, that as many as twenty may be found in a square yard of ground in a good locality.

August 26.—I wonder if there is as much in sexual selection as some writers would have us believe? I was watching a very damaged female 'white' butterfly (*Teracolus sp.*) to-day; not only was it badly rubbed, but the hind wings were so ragged there was very little left of them. A male came sailing up and fluttering around, and she prepared to receive him, when four more males arrived with a rush. Four of the five were in splendid feather as if newly emerged. The female exercised no discretion, being prepared for the first comer. The males exercised none or lacked a taste for beauty and symmetry.

As things go at present, I stand a fair chance of having more influence with the native population than the Governor. To-night, as one of the boys was fetching my dinner, I pulled a couple of feet of grey 'catapult rubber' from my pocket, and, making it twist and wriggle, said 'Nini he' (What's this). Bang! went the plate, and the boy, with a yell as if he were being murdered, precipitated himself from the room. He would hardly approach my end of the table during the rest of the evening. No need to lock my bedroom door, it is a veritable chamber of horrors to them, and it is all one can do to get them in. The door is generally thrown wide open, and the floor scrutinised before entering; having deposited the coffee (or whatever it be) on the table, he clears out with

alacrity. I have seen one boy tremble from head to foot, absolutely shiver, on catching sight of a snake lying on the table. The Museum boy is now quite used to them. At first he took me for an ignorant tenderfoot, and went to the pains of explaining to me how dreadfully bad snakes were. Now he grins when I arrive in the morning with a fresh capture, and merely asks whether it is a bad or good one, as he observes I treat some with due deference to their abilities. Yesterday he was skinning birds, with a live puff adder in a case within a foot of him.

September 3.—Whilst I was skinning a shrike (*Lanius humeralis*) this evening, a fellow boarder—the occupant of the next room—came in to watch. We remarked on what a noise the rats were making, pattering about in the wooden walls. When my friend, returning to his quarters an hour or so later, opened his door, he gave a shout and called me in. The air around his electric light was literally alive with a dizzy, whirling crowd of what I must call ants for want of a better name. I think that is what they are, though they measure exactly one inch, two-thirds of which consist of tan-coloured abdomen, the segments of which they keep telescoping as they walk. Across the spread wings they average $1\frac{1}{2}$ inches, and they have large jaws out of proportion. We shut the window to prevent reinforcements arriving, and with my tweezers I picked them off the curtain and table-cloth as fast as they settled; in this manner I took eighty-four in less than ten minutes. Those outside were striking against the window-panes like hail; but the curious thing was that, though my window was only six feet away and the ventilator wide open, not a single one came in my room. When picked up with tweezers they curl their bodies under.

September 20.—Cycled ten miles out to a Forestry Camp at Ngong. Three days before, my host was cycling out along the same track in a tropical downpour of rain. After a time the road, or rather path, was so bad that he had to fall back on his feet for transport. He was resuming his way, having paused for a few moments to watch a herd of swine which were rooting about and chasing one another close by, when he saw a pair of ears moving through the high grass and in a direction which

would presently bring their owner right across his path. He failed to guess what animal they belonged to till it suddenly emerged from the cover on to a bare piece of rocky ground some fifteen yards from where he was now halted. Then he saw it was a fine specimen of maned lion, his only weapon—a hunting knife—he loosed in its sheath and then rang his cycle bell sharply, for hitherto, owing to the downpour, the lion had neither smelt nor heard his approach. At the sound of the bell the lion promptly halted to listen, and on a second ringing, sharply turned his face in the direction of my friend, and for the space of a few seconds they gazed at one another ; then the lion, with its usual dignity and detestation of undignified haste, trotted off in very much the same direction as it had come.

Near our camp was a military one, where grass was being cut for foddering the transport animals and mules, and our neighbour caught a leopard a few nights before in a strong steel trap ; two hyænas had in their usual cowardly manner attacked the poor creature, and one bit off the tail, one of them also snatched a huge mouthful from its haunch, the skin being pretty well ruined. A year ago, in the same neighbourhood, someone trapped nine leopards in the space of four or five weeks. A night or two before, one was grunting round the camp and came within a hundred yards, so that my host took his rifle and lay outside the firelight to get a shot at it ; the night was pitchy dark however, and he could make nothing out.

On arriving at camp I shot a lizard in a tree, which is new to the collection. Seeing a secretary bird stalking about a plain a quarter of a mile off, we started in pursuit, and my companion got one shot at it with his rifle, but missed ; we spent a warm hour in following the bird about, but it was now far too wary, and we had to give up at last. These secretary birds stalk about in the long grass in the most majestic and stately manner. When you get dangerously near they break into a run, which generally ends in flight, soaring low over the grass for four hundred yards or so. Sometimes our would-be victim would sail right up into the air and, vulture-like, sail round in great circles.

September 21.—Spent all day collecting under a broiling sun ; wore my shirt open ; as it was cool repented this when I

returned to Nairobi, for three days of it made my chest look like raw beef and very uncomfortable. My knickers were worn to shreds at the knees through walking for miles in long grass, and my helmet—an old one—had the cover all worn away in patches through pushing through forest scrub.

I got three males of the somewhat scarce Percival's Oriole (*Oriolus percivali*), which bird is distinguished from the common oriole by a velvety-black shirt front, which looks very handsome against its golden plumage. The only other specimens worthy of mention were three species of shrikes, all new to the collection and as yet unidentified.

Saw no snakes, but found a yard or so of the cast skin of a *Python sebæ* in the dry bed of a stream which flows through the forest just back of our tents; around the waterhole close by was the spoor of a leopard amongst the many tracks of duikers and forest-haunting buck. I never saw any dangerous game during my stay in camp, though last night, when listening to the tales of two other campers, it seemed most promising. We sat around the fire till near midnight, but with my usual misfortune only heard the ribald howling of hyænas.

Owing to the three days of rain, there were a number of very perfect swallowtails about, amongst which I was able to distinguish *P. dardanus*, *phorcas*, and *jacksoni*. If I only had all I saw, I should ere this have a noble collection, but the creatures are most tantalisingly difficult to catch—also, the sun is hot.

September 25.—On arrival at the Museum this morning, someone was awaiting me with what he was pleased to call a number of 'ant's eggs' that had been dug out of a termite's nest in his garden the previous day. They were in three sizes; the largest about 50 mm. long, the next as big as blackbird's, and the smallest, which were shrivelled, about as big as peas. They turned out to be snake's eggs; and I am trying to hatch out the large ones, which are probably those of a cobra or mole-snake. I opened the middle-sized ones, which were too dried to hatch, and they contained very small embryos.

Shortly after, an old gentleman came in with a tobacco tin in his pocket, which he said held a live snake, taken at a disadvantage the previous evening in the act of swallowing a

toad. He thought the snake was a puff adder. I tipped it out on the floor with its dinner beside it; the toad was unfamiliar to me, not being the common species or square-marked toad. After a wash it was bottled, not a bit the worse in appearance from its experiences.

The night adder (*Causus rhombeatus*), for such it was, proved very vicious. It flattened its neck, or, to be more exact, distended it laterally in exactly the same manner as a cobra does, and went sailing about the stone floor with its anterior third raised some four to six inches off the ground, and this though it was not more than twenty inches in length. I have never heard or read of this snake flattening its neck out in this fashion. When approached, it attempted to bite very viciously, and struck at my boot a score of times. Such was the force with which it precipitated itself at any object that annoyed it, that it came very near leaving the ground, an inch or two of tail alone remaining. I turned it into the snake case for the present.

The night I got back from Ngong I found a 'boy' awaiting me with something in a handkerchief, which he said was a live snake. I took it from him and, on turning it out on my table, to my astonishment it was a large night adder; but I soon saw that it was paralysed from about four inches back from the head. It could move the head and neck freely, but no more, so I chloroformed it.

This snake has the longest glands of any viperine snake—they lie alongside the backbone for about three inches from the head; the wonder was that the boy had not got bitten. Still more astonishing was the fact that he would accept no remuneration (baksheesh) for his trouble.

URANIA CRŒSUS

By C. W. Hobley

This gorgeous moth is peculiar to Madagascar, but a specimen was recently found in Mombasa by Mr. P. Dickinson, who has presented it to the Society's Museum.

On the upper side it is black, with transverse bars of a vivid iridescent bluish green. Each lower wing has three pointed tails, very similar to those of certain species of Charaxes butterflies, and there are also three other rudimentary tails edged with white down.

The underside of the under wing near the body is black, with metallic green bars, then comes a narrow zone of purple, and then a wide zone of golden orange with black spots, and then a zone of black with bars of bluish green quite distinct from the green near the body.

The body is a metallic green, with minute black spots on each flank of the abdomen.

The legs are black, with a fulvous down on the thighs.

MIGRATION NOTES

By A. Blayney Percival

February 2, 1916.—During the last few days there has been an almost continuous stream of swallows going north. They fly low and steadily till about 10 A.M. After this they take things more quietly, and may be seen sitting on dead trees and telegraph wires or hawking about after insects.

To-day, sitting near Njoro drift, waiting till it could be made passable, a number of European rollers passed overhead, fully twenty passing in as many minutes. They were mostly in pairs, and, like the swallows, flying due north.

Wheatears, both the common and isabelline, are plentiful and in lovely plumage.

A few yellow wagtails are seen now and then at the water which escapes from the pipes.

Asiatic dotterel are in numbers and apparently in full summer plumage.

February 8, 1916.—Near Makindu I saw from the train large numbers of European storks.

NOTES ON SOME SNAKES COLLECTED BY MR. A. BLACK

By Curator

Among some specimens presented to the Museum by Mr. Black were the undermentioned snakes, and accompanying them were Mr. Black's notes as to the circumstances of their capture. We reproduce his remarks below, and at the same time would like to urge members when sending in specimens to follow Mr. Black's example, as it adds considerably to the value of the specimen to know the locality and date of capture from a zoo-geographical point of view.

Typhlops unitæniatus (I. 128).—Captured in the sand near Kismayu, December 1913 or January 1914.

Eryx thebaicus (I. 129).—Taken around the ' Caves ' about three miles from Kismayu. Date as last.

Boodon lineatus (I. 130).—Date as last.

Coronella semiornata (I. 131).—Date as last.

Tarbophis Guentheri (I. 132).—Was killed at Gobwen on May 1, 1914. ' It is unfortunate that it was decomposed. I have found that a snake introduced alive into methylated spirit will almost invariably keep well, while, on the other hand, a dead one is very apt to decompose. I speak of small snakes. *T. Guentheri* was found in open country whilst returning at night from a visit. My boy, who was walking in front with a lantern, saw the snake crossing the road, and before I could stop him he had sprung forward and dealt it three or four very hard knocks with his stick.'

Tarbophis obtusus (I. 133).—' These young sand-coloured buff snakes were found in crevices in the bark of an " ugunga " tree which had been felled to make way for the telegraph line. These little things looked particularly venomous, coiling themselves backwards on their tails and striking viciously at a lead pencil which I was using to dislodge them from their crevice. I only saw one of what I took to be the matured snake of this species. It was about three feet long, and about three inches' circumference at its thickest part; the tail was long and tapering. Unfortunately, Mr. Harry Rayne, who

killed it, was more intent on its death, than its ultimate preservation as a specimen. He literally blew it to pieces with his shot-gun.'

Amplorhinus nototænia (I. 134).—Capture during December 1913 or January 1914, around the 'Caves' about three miles from Kismayu.

N.B.—The first four of these are harmless; the last three belong to the back-fanged group of colubrines, and are not dangerously venomous.

CURIOUS GROWTH OF FUNGUS

EDITOR

In No. 9 of the Journal, p. 59, Mr. Dobbs described a curious growth which appeared on the grass at Kericho Station in Lumbwa District.

A record of what is probably a similar occurrence is recorded in a book entitled 'Fighting the Slave-hunters in Central Africa,' by A. J. Swann, p. 116. The following is Mr. Swann's description:

'In crossing the high plateau between Lakes Tanganyika and Nyassa, I was shown a very curious white substance very similar to porridge. It was found on the ground early in the morning before the sun rose.

'On examination it was found to possess all the characteristics of the manna which is said to have fallen for the benefit of the Israelites.

'In appearance it resembled coriander seeds, was white in colour, sweet to the taste, melted in the sun, and if kept overnight was full of worms in the morning. The natives were not allowed to gather it without permission from their chief.

'It required to be baked if you intended to keep it any time.

'It looked as if it was deposited on the ground in the night; but in what manner I could not determine.

STONE IMPLEMENTS. Locality not known.

Rock—Nepheline basalt (the white crystals are Sanidine).

The centre specimen is a hammer and might originally have been a core, it exhibits signs of working.

'No holes could be found in the ground near it, or one might have concluded that insects unearthed it.

'The only suggestion I could think of was that it might be a mushroom spawn, as on the spot where it melted fungi sprang up the next night.'

ON SOME STONE IMPLEMENTS

By C. W. Hobley

About two years ago some stone implements were lodged on deposit at the Society's Museum by a Mr. Harrison, who was then serving in the locally recruited military forces. These implements were, it is believed, collected in British East Africa, but the depositor left no information as to locality. They are interesting on account of their being much larger than any other implements previously found in the Protectorate. They are all axes or *bouchers*, except one hammer stone, and the flaking is very bold, but all the specimens are unfortunately water-worn, which detracts from their scientific value, as it is not so easy to determine the type of workmanship. They are made of the type of Nepheline-sanidine basalt, which occurs on the Yatta Plateau, east of Donyo Sapuk, and runs along the eastern bank of the Athi River. A plate showing some of the specimens is given.

LIFE-HISTORY OF THE COCONUT BEETLE

Editor

The beetle, *Oryctes monoceros*, is a great pest of the coconut plantation at the coast.

The adult insect holes down into the trunk, and lays its eggs; the larvæ hatch out and feed on the interior of the stem, retarding its growth and often killing young plants.

Mr. Farmer, of the Agricultural Department, supplies the following data regarding its life-history which will probably be of interest to planters.

Egg stage, twelve days.

Larval stage, three months.

Pupal stage, forty days.

Length of adult life unknown.

OBITUARY

Editor

It is with profound regret that I have to record the death of Mr. John Sergeant, the Honorary Secretary of the Society. He was killed in Nairobi in a motor accident on the afternoon of Tuesday, March 28, 1916.

At the inaugural meeting of this Society, held at the Lieutenant-Governor's bungalow on March 25, 1909, Mr. Sergeant was proposed as Honorary Secretary of the Society by his Excellency Sir Frederick Jackson. He accepted the post, and the success of the Society has been in a large measure due to the unstinted labour that he has devoted to its affairs.

Before coming to East Africa he was one of the founders of the Avicultural Society, and he maintained a large aviary of British and foreign birds. The study of the habits of birds, of which he was a careful observer, continued to be his special hobby in this country.

For his unassuming character, and his complete efficiency in the discharge of any duties which he undertook, Mr. Sergeant earned the unqualified respect of his colleagues, both in the Society and in his own Department of Government, the Public Works. His death has been a severe blow to his large circle of friends, and their deep sympathy is extended to his sorrowing widow.

EVENING LECTURES

By Hon. Secretary

The first three of the new series of monthly meetings have taken place, and appended is a report.

The first to be given was by the Honorary Secretary, the subject being 'Some of the Common Birds of Nairobi District.' The lecture was illustrated with about 150 beautifully coloured lantern slides. Most of the birds shown were of the smallest species, and it must have been with great difficulty that the photographs were obtained.

Warblers, fly-catchers, larks, cuckoos, sun-birds, woodpeckers, and nightjars were all shown in natural surroundings, usually in attendance at their nests and young.

Several of the birds shown had, so the lecturer informed us, become so tame and used to the camera that in the end they would allow the photographer to approach right up to them, and, not showing any fear, would allow him to stroke them as they brooded over their eggs or young.

Some interesting habits were referred to by the lecturer, and many of the photographs exhibited birds in positions that would have been incredible had it not been for the fact that the pictures were direct photographs, and not distorted drawings.

Amongst the tricks of the bird-photographer explained by the lecturer was that of stopping up the mouth of the nest and so preventing the parent birds from entering in their usual hurry, and so giving time for a picture to be taken. This was shown in several instances, including a woodpecker carefully withdrawing the obstructing bunch of paper.

The second lecture was delivered by E. Battiscombe, Esq., on 'The Commoner Trees of Nairobi.' The lecturer exhibited some thirty-six kinds of trees and shrubs, illustrating the various stages in their growth and reproduction. The lecturer also mentioned the commercial value or otherwise of each tree which came under review, and in this connection it was

extremely interesting to learn that two tons of olive were equal to one ton of coal as fuel.

The third lecture was given by A. B. Percival, Esq., the subject being 'The Game Birds of East Africa and Uganda.' As the subject was such a big one, the lecturer intimated that he would have to confine his remarks to the francolins, guinea-fowl, bustards, quail, and sand-grouse. During the course of his remarks the lecturer exhibited some seventeen species of francolin, five guinea-fowl, three bustard, four quail, and four sand-grouse. The known distribution of each species was mentioned and their habits described.

At a future date, it is hoped, the lecturer will continue his remarks on the game birds and deal with the ducks, snipe, pigeons, doves, and plover.

Reports on subsequent lectures will appear in the next number of the Journal.

AMENDMENT TO RULES OF THE SOCIETY

By Honorary Secretary

The following was passed at a general meeting of the Society held on September 8, 1916 :

Rule 6*c* to be amended as follows :

1. The class of Associate member to be abolished for the future. The present Associate members are to be given the option of becoming full members or remaining as Associates. Those who choose to remain as Associates to retain the privileges of that class.

2. A new class of members to be formed, and members of this class to be called Junior members—the subscription for this class to be Rs. 5 per annum. They will not be entitled to receive any of the Society's publications.

3. A fee of Rs. 7/50 be charged as an entrance fee to the Society in addition to the first annual subscription of Rs. 15. Junior members are not to be charged entrance fees.

4. The subscription of a Life Member shall be Rs. 150.

LIST OF DONORS OF SPECIMENS TO THE SOCIETY'S COLLECTION. January to December 1916

Barber, G. R. . .	One large spider.
Beaton, Master K. .	One large skink and eggs.
Bowker, H. M. .	Weaver-bird's nest (*Sitagra suahelica*). Nest of abnormal length.
Bowker, M. E. .	Two yellow-billed turacos (*Turacus Rossi*).
	One white-headed turaco (*T. leucotophus*).
Chart, Nye . .	One turtle.
	One bustard skull.
Collyer, Miss . .	Skull of pig.
Cook, J. P. . .	One otomus, with skull.
	One dendromus, with skull.
	One hawk (*Melierax gabar*).
	One heron (*Ardea purpurea*).
Creighton, G. K. .	Set of 'Encyclopædia of Sport.'
	Two snakes.
	Two skinks.
	Parasites on caterpillar.
Creighton, Master .	Six frogs.
	Five toads.
	Four pointed-nose frogs.
	One mouse-bird (*Colius affinis*).
	Two frogs (alive).
Cunningham, R. B. . (jointly with Dr. van Someren)	Collection of 200 butterflies, including some rare forms of *Papilio dardanus*.
	Seasonal variations of several other species, and several West Coast and South American species.
Dent, R. E. . .	Mounted head of springbok.
	One skin of duck (*Thalassornis leuconotus*).
Dobbs, C. M. . .	Spherical stone ploughed up at Sotik.
	One witch doctor's outfit.
Douglas, Mrs. F. W.	One mummified foot from Luxor.

Franklin, F. . .	One dotterel (*Ochthodromus asiaticus*). One wheatear. One shrike. One pipit. (Skins.)
Grant, D. K. . .	One blind snake. One beetle.
Hemstead, Lieut. .	One heron (*Ardea goliath*). One kingfisher (*Corythornis maxima*).
Hobley, C. W. .	One octopus. One snake.
Kabete Lab. . .	Three skins and skulls of wild pigs.
Knight, W. E. D. .	Two larvæ of beetles in cocoons.
McMillan, Major .	Four snakes.
O'Meara, Master .	One hornbill (in the flesh).
Pagden, N. G. . .	One snake.
Pirie, J. H. . .	Collections of shells from Karungu and Mombasa. Two mole-rats. One larva
Rainsford, Capt. .	One female white ant. Two scorpions (large). Five scorpions (small). One stick-insect. One frog. One spider.
Roche, Lieut. . .	Box of insects from Karungu.
Ross, McGregor .	Two snakes.
Smith, Seth M. .	Four sand-grouse.
Southan, Ajar . .	One snake (alive).
Storey, E. J. . .	A large and well-preserved collection of moths from Makupa Bridge, Mombasa. A second collection. Ditto.
Turner, H. J. A. .	Fœtal flying squirrel. Three *Tropidonotus olivaceus*. Four *Chlorophis Emini*. Two *C. hoplogaster*. Five *C. irregularis*. Three *Rhamnophis Jacksoni*.

Turner, H. J. A. . Three *Grayia tholloni*.
Three *Causus resiinus*.
Four *C. Lichtensteini*.
One *Bitis nasicornis*.
Three *Atheris squamiger*.
Eight lizards.
Four chameleons.
Two toads.
Two tortoises.

Van Someren, Dr. . *Groups of mounted birds :*

Four starlings (*P. verreauxi*) showing stages in plumages.
Two African golden orioles (*Oriolus notatus*).
One brown-headed weaver (*S. insignis*).
Two yellow-billed pigeons (*Columba arquatrix*).
Three long-tailed mountain starlings (*A. morio Sb.* sp.).
Two bush shrikes (*T. senegalus*).
Two crimson-bellied shrikes (*Lanius erythrogaster*).
Two bee-eaters (*Merops albicollis* and *M. bullockoides*).
One lesser flamingo (*Phœnicopterus minor*).
One lily trotter (*Parra africana*).
One hoopoe (*Upupa africana*).
Two pied kingfishers (*Ceryle rudis*).
One black-headed oriole (*Oriolus l. roletti*).
Two duck (*Anas undulata, Anas capensis*).

Birds in the flesh, mounted by Mr. Turner :

Harlequin quail (*Coturnix Delagorguei*).
Masked forest-shrike (*C. nigrifrons*).
Three guinea-fowl (*Numida Reichenowi*).

Van Someren, Dr. . Two spur-fowl (*P. infuscatus*).
One white-bellied crow (*Corvus scapulatus*).
Two yellow-throated bulbuls (*S. eugineus*).
Two trogons (*H. marina*).
One flamingo, immature dress (*Phœnicopterus minor*).
One common brown vulture.
Also 36 birds in the flesh, made into study skins. Mostly new to Society's collection.
One hare skin and skull.
One Gennette cat's skin and skull.
One yellow mongoose, since mounted.
One suni (*Neotragus moschatus*).
Four young mice.

Wilks, C. L. . . One white-necked pigeon (*Turturœna Sharpei*), since mounted.

The following specimens have been received without names of donors:

One leopard skull.
Four large shells.
Two live tortoises.
Eight dead tortoises.
One book on collecting butterflies.
One head lesser koodoo.

The Journal
OF THE
EAST AFRICA AND UGANDA NATURAL HISTORY SOCIETY

FEBRUARY 1918 VOL. VI. No. 12.

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EDITOR

C. W. HOBLEY, C.M.G.

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FRANCOLINUS NAHANI.

about $\frac{5}{8}$ nat. size.

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ANOTHER RARE FOREST FRANCOLIN

Francolinus nahani, Dubois

(Type locality—Ituri Forest, Congo)

By Dr. V. G. L. van Someren

This rare Forest Francolin was described by Dubois, in 1905, from a single immature specimen, which has been sent home in a batch of birds from the Ituri Forest, Belgian Congo.

Although this bird was obviously young, yet it possessed such striking differences from any of the known and described species of Francolin that Dubois had no hesitation in describing it as a new species, and thus being first in the field with one of the most interesting ornithological discoveries from Africa within recent years.

From 1905 to 1913 nothing further was heard of this bird until specimens were sent to me by my collectors, along with that other rare Francolin, *F. l. schubotzi,* from the Mabira Forest, Uganda.

This forest is, roughly, 220 miles east, in a straight line, from the Ituri Forest. This fact is extremely interesting, for this bird is purely a forest species, and there are no large forests in the intervening country.

One point of dissimilarity between the Mabira birds and that from the Ituri is in the colour of the legs and bill: these were described as being grey, whereas in all my specimens these parts are crimson. This discrepancy may be accounted for by the fact that the colour of the legs fades after death; but in no single specimen in my collection are the legs grey, but rather a brownish yellow.

The sexes are alike.

Very little is known regarding the habits. My collectors report that these birds go in pairs and are frequently seen with guinea-fowl, and indeed they mistook *these* birds for young

of that species, until a specimen was procured. This mistake was quite pardonable on account of the poor light which filters through the tops of the thick foliaged trees.

I myself have only seen these birds on one occasion ; they were feeding under the undergrowth, and their presence was detected on account of the rustling of the dead leaves on the ground as they scratched and hunted for seeds and snails, which food appears to be their chief diet.

They were shy and most difficult to procure.

Like *F. l. schubotzi,* these birds are much smaller than most of the other francolin, and possess very slender bills.

So far as I am aware, neither eggs nor nestlings of these birds have been taken.

It is to be hoped that further information regarding these two rare Forest Francolin will be sought for by members living near the Mabira Forest.

SOME NOTES ON THE EARLY HOMINIDÆ

By E. Wynstone-Waters, F.R.S., Edinburgh. (*Late Senior Demonstrator of Anatomy at the Royal College of Surgeons, Edinburgh.*)

The discovery in 1912 of the Piltdown fragments has supplied us with a fifth species of the Hominidæ. Before touching on this interesting find, it will be well to review briefly the salient features of those portions which have been discovered of the other species.

In the year 1865 Sir John Lubbock (the late Lord Avebury) introduced two terms, which have since been in very general use. He proposed that the Stone Age should be divided into two portions. The people of the later period he called Neolithic ; while, extending far behind this Neolithic stock, and living under very different climatic conditions, we have what he termed the Palæolithic peoples—races of savages which roamed about during the glacial epoch, and were contemporary with such extinct forms as the Mammoth Elephant, Cave Bear, &c.

Pithecanthropus erectus or Homo Javanensis

In the year 1891 Dr. Eugène Dubois discovered in the Island of Java (whither he had gone with the firm intention of discovering the missing link) a portion of the calvarium or

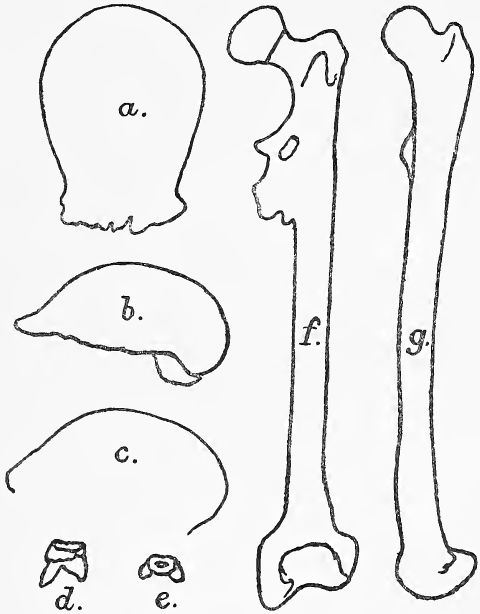


Fig. 1.—Pithecanthropus erectus, Dubois. *a*, Skull-cap viewed from above; *b*, in profile; *c*, in vertical-mesial section; *d* and *e*, the first molar tooth found; *f g*, femur from the front and in profile. (After Dubois.)

skull-cap, and a third molar tooth of the right side. In the following year a left femur or thigh-bone was found at a distance of about 50 feet from the tooth, and a little later the second molar tooth of the left side was discovered. It should be noted that though these bones and teeth were not found in close proximity, still they occupied the same horizon (Fig. 1). These bones have been subjected to a most careful examination by the leading European anatomists.

The opinion of these experts is divided: some regarding

Pithecanthropus as a man with marked simian tendencies, while others look upon him as an ape with some human characters. Dr. Dubois' conclusion is that it represents a stage midway between the anthropoid apes and man. Professor Cunningham notes a marked resemblance to the Gibbon, and Professor Schwalbe is also on the side of the apes.

A plaster cast of the internal surface of the calotte shows approximately what would have been the general form of the brain. The speech area of the brain is situated in the inferior frontal gyrus or Broca's area. Measurement of this area in the case of *Pithecanthropus* shows that it is twice as large as in the higher apes, and about half the size of that in normal man. It is more than probable that this first man was capable of a rudimentary form of speech.

Dr. Dubois made very careful measurements of the capacity of the calvarium; according to him the cranial cavity had a capacity of 850 c.c. The cranial capacity of the highest apes never exceeds, if it ever reaches, 600 c.c.

In a normal human being it never falls below 880 c.c. The average of these figures is 740 c.c., and this should represent the capacity of *Pithecanthropus*, supposing his position to be intermediate between the highest ape and normal man. *Pithecanthropus*, however, exceeds this by 110 c.c., and for this, the highest of all reasons, must be included in the human race. He has laboriously climbed far up the ladder, and few steps only lie between him and the dignity of *Homo sapiens*.

Some anatomists describe the remains as more pre-human than human; but at present nobody denies that they present a form intermediate between man and the generalised simian prototype. These remains do not for a moment bridge over the gap between man and the gorilla, but they form a true link, connecting man to the common stock from which all have diverged. That great authority, Manouvrier, states that *Homo Javanensis* maintained the erect posture, and with this attitude comes the differentiation of the extremities into hands and feet, which is a human characteristic of the first magnitude. The diagram (Fig. 2) shows the position of *Pithecanthropus* as intermediate between the chimpanzee and

the man of Spy, about whom I shall have more to say; and Manouvrier is of opinion that it may be more directly connected with the Australian race. Keane, in his 'Man, Past and Present,' suggests that the race of Trinil (Java) was the common ancestor of many human races, if not of all those that have been subsequently differentiated.

Professor Hepburn is very emphatic regarding the distinctly human character of the femur, also that it antedates

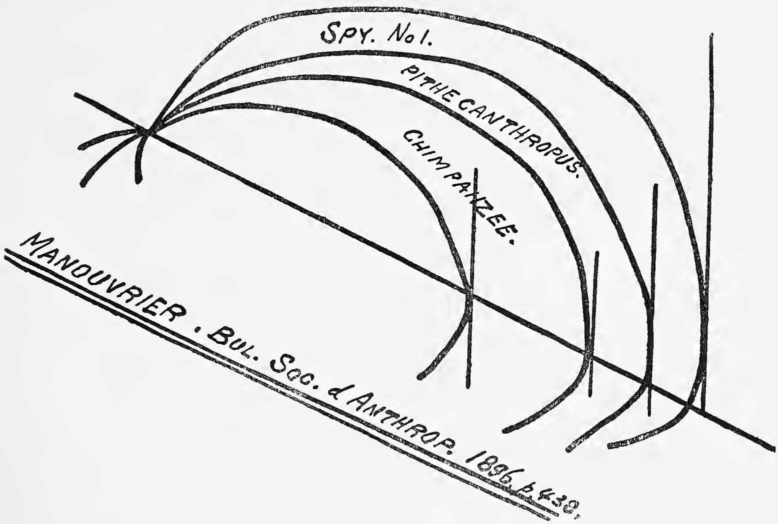


FIG. 2.—POSITION OF PITHECANTHROPUS ERECTUS.

all other human remains yet discovered, and that of living races the nearest akin are the Australians, Andamanese, and Bushmen, thereby lending support to the view that these 'low races spring from a common primeval stock' which originally inhabited the now vanished Indo-African continent.

In a sense this Upper Pliocene citizen of Java may be looked upon as the 'first man'; and as there is a strong probability that he could not have had any human ancestors elsewhere, 'the Indo-Malaysian intertropical lands' may, with a considerable amount of credence, be looked upon as the cradle-land of the human race.

This first man had in all probability occupied a large area, including the Sunda Islands and Indo-China—regions then

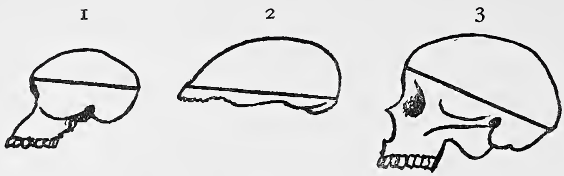


FIG. 3.—1, SKULL OF CHIMPANZEE. 2, CALVARIUM OF PITHECANTHROPUS. 3, SKULL OF MODERN MAN. Lines are drawn from points between the eyebrows to the occipital ridge at back. It will at once be seen that the dome of the skull of Pithecanthropus is much shallower than that of modern man. (From Sir E. Ray Lankester's *Extinct Animals.*)

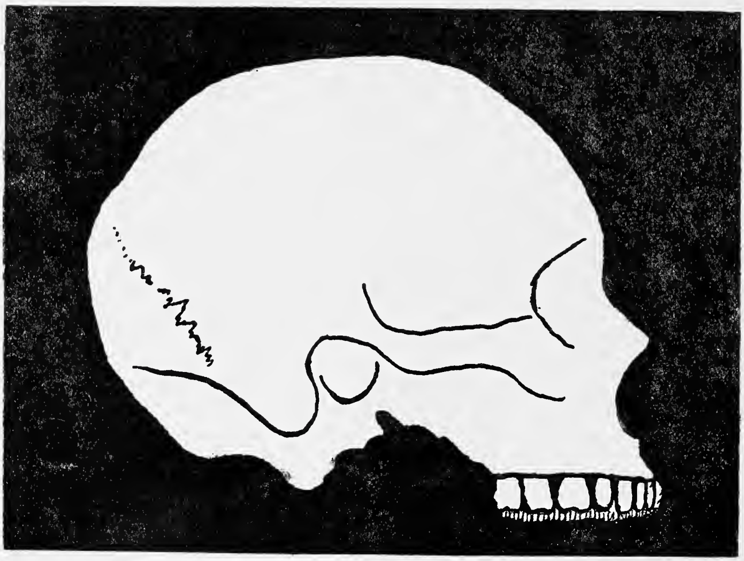


FIG. 4.—SKULL OF MODERN EUROPEAN RACE.

connected by land across the shallow waters which now exist between the Malay Peninsula, Borneo, and Java (Figs. 3 and 4).

Dr. Munro, in a thoughtful paper read before the Edinburgh Royal Society (Jan. 4, 1897), says: 'If the geological

horizon of the Java man were correctly defined as the borderland between the Pliocene and Pleistocene periods, one could form some idea how far back we had to travel to reach the common stock from which men and anthropoids had sprung.' The lower races of to-day, he concluded, were also survivals of intermediary links, which had been thrown into the side eddies of the great stream of evolution.

I will now dismiss the Java man with the statement that, besides having acquired the erect posture, he was of the average height of 5 feet 6 inches.

Homo Heidelbergensis.—With the dismissal of *Homo Javanensis* we find ourselves being introduced to a new species in the person of *Homo Heidelbergensis.*

Dr. Schoetensack, in 1909, at a place called Mauer, to the south-east of Heidelberg, discovered a perfectly preserved lower jaw of a primitive man, which justly claims to represent a new species. It was discovered in a bed of sand about 80 feet from the surface, and from these sands bones of several different animals have been brought to light.

Among the more important of these are the bones of *Elephas antiquus*, a form allied to the African elephant; also those of *Rhinoceros etruscus*, a species not uncommon in the Upper Pliocene deposits; a lion much like our African form; also several deer.

Teeth of a horse are also present, the species being intermediate between the existing *Equus caballus* and the Pliocene *Equus stenonis.*

The presence of *Elephas antiquus* takes us back to the Lower Palæolithic horizon, while *Rhinoceros etruscus* points to a date still more anterior. In the opinion of those best able to judge, the Mauer sands were laid down during the first genial interglacial period.

The Heidelberg jaw is unique in many respects. The dentition is normal, and is quite human in every respect; the canines do not project beyond the other teeth, the incisors are small, not larger in fact than those of the present races of men. 'The dentition is in some respect less simian than that which may be sometimes observed in existing primitive races—such, for instance, as the Australians' (Prof. Sollas,

'Ancient Hunters,' 1911). The front teeth do not project; they are curved at their roots on account of following the sloping contour of the jaw in the region of the symphysis menti. It is an ascertained fact that in apes the third molar is cut either before or, at the latest, at the same time as the permanent canine. Supposing the jaw to have belonged to an ape, one would have found that the third molar was

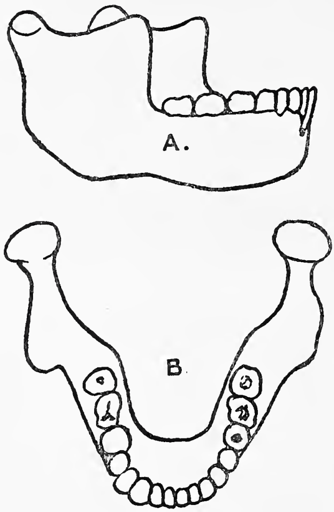


FIG. 5.—THE HEIDELBERG JAW. A, From the side; B, from above.

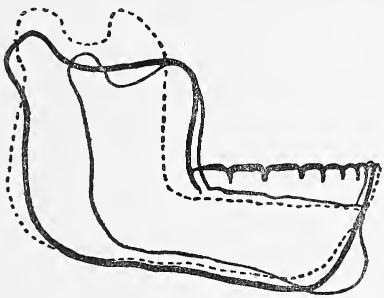
as much worn as the canine, but in the Heidelberg jaw this is not the case—a strong factor in favour of its human character. This interesting fact was pointed out by Dr. Siffre (see 'À propos de la mandibule Homo Heidelbergensis,' *Bull. Soc. Anthrop.* Paris, 1909).

The jaw itself shows little that is human in its appearance. Its principal characteristic is its enormous body, and the great breadth of the ascending rami. The merest tyro in anatomy could not fail to be struck by these simian characters, and had this jaw been devoid of teeth, there are some anatomists who would doubtless have described it as belonging to an ape (Fig. 5).

The crucial differences between the human and simian jaw are found in the region of the anterior extremity—that region where the two halves are welded together to form the so-called symphysis menti.

The chin is a modern human acquirement, and is absent in the apes.

In the ape the contour of the jaw at its anterior extremity forms a sudden back-sweeping curve. The Heidelberg jaw



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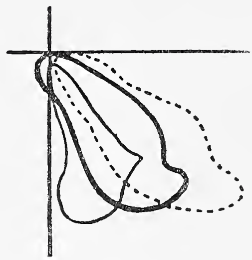


B

Fig. 6.

Mauer Jaw = thick line; Australian Native = thin line; Chimpanzee = broken line.

Vertical mesial section through the symphysis of Mauer jaw (thick line); Australian (thin line); and a chimpanzee (broken line).

possess no chin, the contour here being exactly what one finds in the apes. This is well seen in Fig. 6.

The internal surface of the region of the symphysis in the present races of man slopes sharply downwards from the posterior surface of the incisors, and as a rule does not show any differentiation into regions. In the higher apes the slope is very gentle, especially in its upper portion. With regard to this peculiarity the Heidelberg jaw holds an intermediate position. If the internal surface of the symphysis menti of a modern man is examined, it will be noted that in its lower one-third it shows what are called mental spines: the lower being a slight median ridge or roughness to which are attached the genio-hyoid muscles, the upper forming a

pair of somewhat prominent tubercles which give origin to the genio-hyoglossi muscles. (See Fig. 7.)

In all the apes this spinous roughened surface is absent, and is replaced by a depression. In most of the primitive jaws this ape-like condition maintains, but in none is it so marked as in the Heidelberg jaw.

The jaw itself is very massive, the excessive breadth of the ascending rami pointing to an abnormal size of the masseter

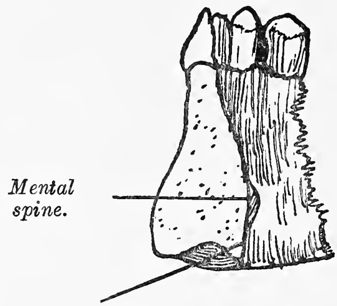


FIG. 7.—VERTICAL MESIAL SECTION OF INFERIOR MAXILLA OF MODERN MAN. The upper mental spines form a pair, showing bilateral symmetry. The lower are in the form of a small median ridge. (Modified from *Quain's Anatomy*, vol. ii. pt. i.)

muscles, and this in its turn hints at an enormous development of the zygomatic arches.

A word before leaving *Homo Heidelbergensis.* The earliest known remains have been discovered in two deposits : (*a*) the Trinil beds of Java, and (*b*) the Mauer sands of Heidelberg—deposits laid down at a period not far removed from the dawn of the Pleistocene.

As pointed out by others, it is interesting to note that the lower form (*Homo Javanensis*) occurs in that portion of the world where the most primitive races (Australian &c.), until lately, continued to thrive; while on the other hand the higher form (*Homo Heidelbergensis*) wandered over Europe,

which has for a very long time been the birth-place of the highest intellects of the world.

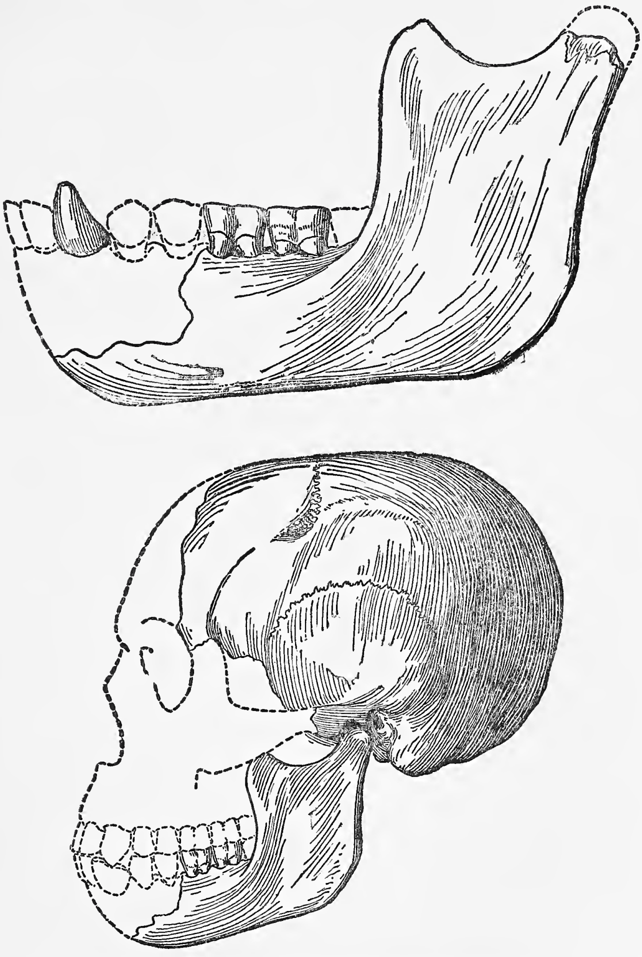


FIG. 8.—SKULL OF EOANTHROPUS DAWSONI.

By kind permission of the Geological Society.

The Piltdown Race, *Eoanthropus Dawsoni*. (See Fig. 8.)—In 1912, Mr. C. Dawson and Dr. Smith Woodward made a discovery in Sussex, which is of the utmost scientific importance, and has resulted in a fifth species of the Hominidæ.

The chief points of interest in regard to the Piltdown skull are :—

1. The brain-case is, without a doubt, human ; the vault of the skull, and the flat bones generally, are, however, of much greater thickness than in modern man. It would be interesting to know whether the pachyonian bodies had been evolved in these early men, as there can be little doubt that their presence is closely related to the thinning out of the cranial vault, which in modern man forms so marked a contrast to what maintains in primitive skulls.

I have no work of reference at hand, but, if my memory is not cheating me, these bodies which spring from the arachnoid mater, or middle membranous covering of the brain, do not become functional until about the age of eighteen, after which period they continuously exert an absorbing influence on the inner table of the cranial vault, and thus prevent too great a thickening from occurring in this region. It might be offered as a suggestion that in modern man, where the brain is so highly developed, this thinning-out influence of the pachyonian bodies was associated with the growth of the brain, and by their presence prevented any encroachment of the inner table of the skull in the direction of that most delicate organ.

2. The cranial capacity is about 1070 c.c., which is low, but is not lower than the lowest savages of to-day.

3. The forehead is fairly developed, and there is an absence of the massive brow-ridges (superciliary ridges) which are so characteristic of some ancient skulls.

4. The lower jaw offers some interesting points for examination. The ascending rami are wide, and the sigmoid notch (which lies between the two projections surmounting the ramus—namely, the condyle and coronoid process) is shallow.

5. The symphysis or junction of the two halves of the jaw is reinforced by a distinct plate of bone situated on the internal aspect, which sweeps across the angle of recession, and evidently adds great strength to this part of the jaw. In modern man this osseous bridge or ledge is absent, and it is well to note that it is a structure of purely simian nature. (See Fig. 9.)

The roughness for the genio-hyoid and genio-hyoglossi muscles are absent ; and when this is taken in conjunction

with the fact that the mylo-hyoid ridge and the surface of attachment for the internal pterygoid muscle on the inner aspect of the angle and ascending ramus are poorly developed, one may be reasonably allowed to conclude that the race represented by *Eoanthropus Dawsoni* was speechless.

6. The front of the original jaw was absent; but the dis-

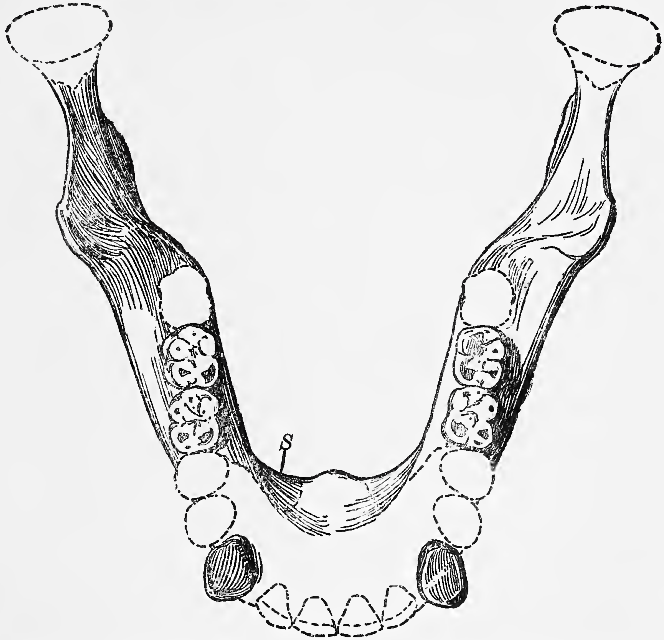


FIG. 9.—THE PILTDOWN JAW. *S*=HORIZONTAL PLATE OF BONE.
By kind permission of the Geological Society.

covery a few months later of a canine tooth shows that the modelled teeth are in harmony with nature.

The teeth are of great size, eclipsing all the members of the Hominidæ with the exception of the Java man.

The Piltdown skull is in all probability contemporaneous with the Palæolithic implements found in its proximity. These implements point to the Chellean epoch, and Woodward's explanation of the presence of such a markedly simian jaw on a Chellean horizon is that this race, living in the region of Britain, was the last remnant of a very ancient stock, which probably was exterminated by *Homo Heidelbergensis*.

The Heidelberg jaw must be referred to the first interglacial period, and the Piltdown skull to the second.

There is a strong probability that the Piltdown skull belonged to a woman, the evidence for such a conclusion being based on the somewhat small cranial capacity, and also on account of the slender nature of the jaw and the smallness of the brow-ridges.

Homo Neanderthalensis or Mousterian Man. Near Düsseldorf the Düssel valley is much narrowed to form a gorge, called the Neanderthal. In this region are found several caves, among them being the far-famed Neanderthal cave, in which the well-known skull was found and from which the fourth species of the Hominidæ has taken its name. This wonderful specimen was first described by Schaffhausen; and Prof. Huxley, speaking of it, says: 'Under whatever aspect we view this cranium, whether we regard its vertical depression, the enormous thickness of the superciliary ridges, its sloping occiput, or its long and straight squamosal suture, we meet with ape-like characters, stamping it as the most pithecoid of human crania yet discovered.' These words of Huxley carry the same weight to-day as when they were uttered.

Recognising the skull as human, but at the same time the most simian-like he had ever examined, he placed it on a lower level than the Australian, believing, however, that this race represents its closest relatives.

When the skull was first examined there were many who doubted its human character: the famous Virchow attempting to elucidate the abnormal appearance of the skull-cap by ascribing its eccentricities to the effect of disease.

New discoveries, however, followed which settled the question as to the normal nature of the Neanderthal specimen, each new piece of evidence acquired only going to strengthen Huxley's dictum of 1863.

At present there is a large amount of material representing the Mousterians. A few may be mentioned: A lower jaw found at La Naulette in 1866; a portion of a lower jaw from Sipka, 1879; two skeletons from Spy, 1885; many fragments from Krapina; the specimens from La Chapelle aux Saints and Le Moustier.

On examining a Neanderthal skull from the front, the one outstanding feature which most forcibly strikes one is the enormous development of the superciliary ridges and glabella. There is not only an enormous exaggeration of these parts, but they have as it were all become joined up so as to form a continuous elevation extending from the external angular process of one side, traversing the region immediately above the supra-orbital margin, becoming confluent with the glabella, and, passing above the supra-orbital margin of the opposite side to the region of the opposite external angular process, forming what has been termed the frontal torus. (See Fig. 10.)

The existing race which makes some approach to this condition is the Australian, but only in a very modified degree: the only portion of the torus which in any way approaches in size the Neanderthal skull being the region of the glabella.

Coursing along the upper margin of the torus is a depression, which by its presence greatly adds to the massive appearance of this high ridge. There is nothing homologous to this in the Australian skull.

The bony orbits are peculiarly large, and slope, as it were, upwards on to the region of the forehead—a characteristic well marked in the anthropoid apes.

The anterior nasal aperture is of great size, and it is safe to surmise that the fleshy parts of the nose were very massive.

In some of the Neanderthal race marked prognathism was present, as in the skull from the cave of Le Moustier; while in others, as in the Gibraltar skull, orthognathism was the normal condition.

The lower jaw shows hardly any rudiment of a chin, the jaw itself being very massive.

The Heidelberg jaw showed this characteristic in an even more accentuated form; so it would be just to conclude that the chinless condition (which is markedly simian) is gradually disappearing.

The canine teeth are very large, the incisors being small. In *Homo sapiens* the first molar is larger than molar 2, and molar 2 than molar 3; in *Homo Neanderthalensis* this order is reversed.

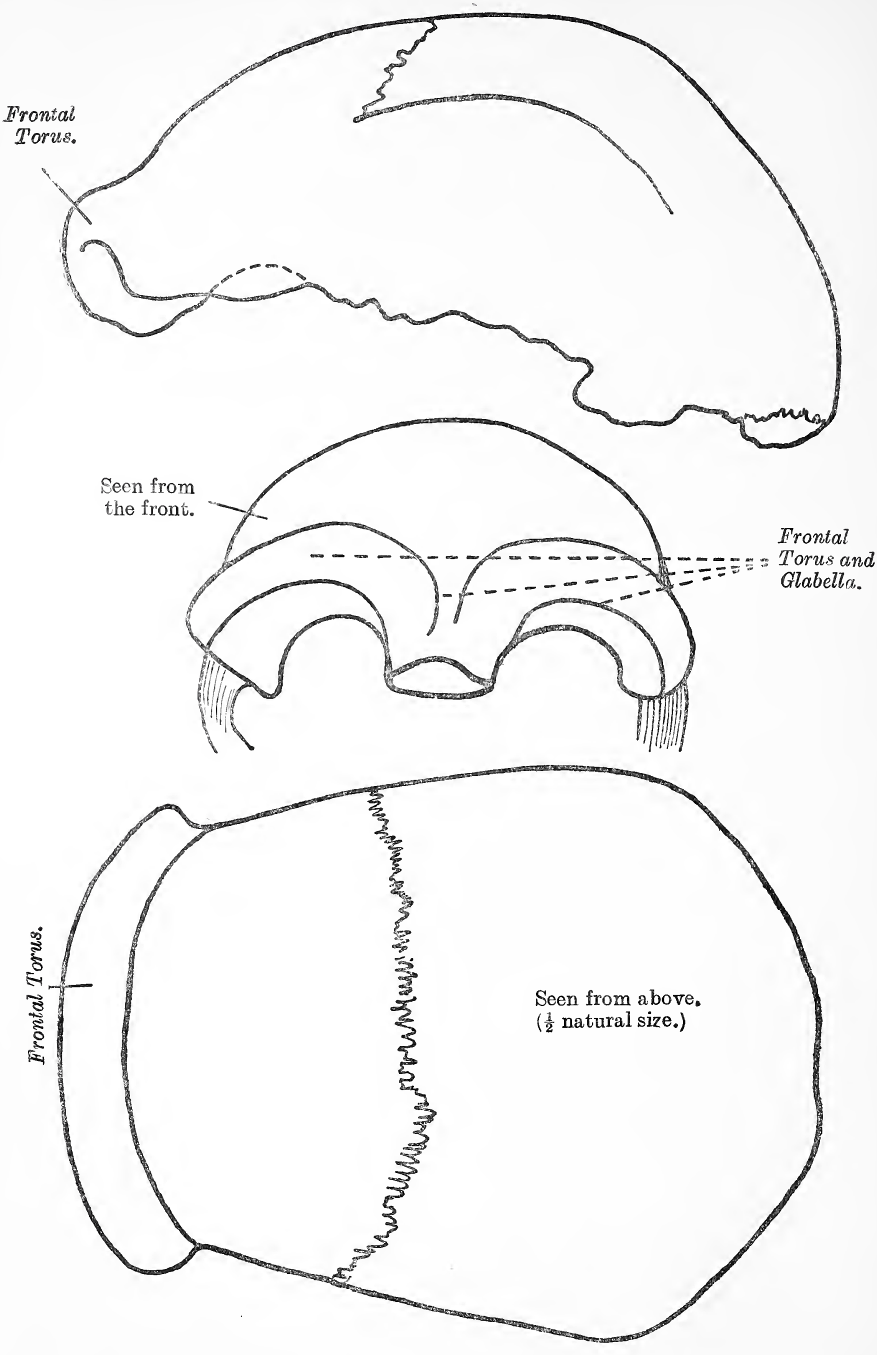


FIG. 10.—THE NEANDERTHAL SKULL. Seen from the side. ($\frac{1}{2}$ natural size.) The outlines from camera lucida drawings by Mr. Busk.

The frontal bone immediately above the torus slopes rapidly backwards, the vertex being low and flat. The bones of the skull are of great thickness, especially in the region of the superciliary ridges.

In the frontal region the base of the skull is abnormally high, thus encroaching on the space reserved for the frontal lobes of the brain. It must not be concluded from this that the Neanderthal race possessed a small cranial capacity, for careful measurements of the La Chapelle aux Saints skull gave the enormous capacity of 1600 c.c. Other skulls of the race give similar measurements.

Fig. 11.—The Gibraltar Skull (after Sollas).

The Gibraltar skull, however, is an exception, giving a capacity of 1250 c.c. Should this skull be that of a woman, another 150 c.c. added would give 1400 c.c., which would be the relative weight for a man. (Fig. 11.)

As regards cranial capacity the Neanderthal race is superior to the modern European, with an average capacity of 1500 c.c.

It is evident from the above that the Mousterians were a big-brained race; their nearest living allies, the Australians, being much inferior in this respect.

The two Spy skulls, discovered by Professor Max Lohest, are in complete harmony as regards anatomical detail with the Neanderthal specimen.

The jaw found in the cave of La Naulette shows very simian characters, so much so that Virchow denied its human

origin. Since then, however, other specimens have come to light—especially the Krapina fragments—which have removed any doubts which existed, and it must be ascribed to the Neanderthal race.

The rock shelter of Krapina was doubtless formed by the ancient Krapinica river, since which the river has sunk 80 feet below the base of the recess.

On the floor of the cave is a layer of pebbles deposited by the river; this layer is covered by one of sand. Here and there patches occur of a grey and red colour. These tell of a series of human occupations, burnt and broken bones and

Fig. 12.—The Skull of La Chapelle aux Saints (M. Boule).

stone implements being found in them. The remains of a dozen individuals or so have been discovered, which are all distinctly Mousterian in their characters.

The bones, strange to say, show unmistakable signs of having been subjected to the action of fire, and for this reason some have voiced the suspicion that Mousterian man was addicted to cannibalism.

The skull found at La Chapelle aux Saints, especially as regards the skull-cap, agrees very closely with the Neanderthal specimen. The implements found on the same horizon are truly Mousterian. (Fig. 12.)

The skeleton found at La Moustier belonged to a youth of about sixteen years of age. The great cranial capacity is in harmony with the skulls from La Chapelle aux Saints and Spy.

There is strong evidence from all these remains that the Mousterians possessed extraordinarily large heads, and were of short stature.

It should be remembered that Mousterian man was essentially a cave-dweller. His remains, however, have sometimes been discovered in open country, but these areas probably only represented summer stations.

Palæolithic man lived during the Pleistocene or glacial period. It is well known that in Britain the glacial period was not continuous, but was subdivided into probably four cycles by three warm interglacial periods.

The Palæolithic Age has been subdivided into certain epochs, which mark the different stages of cultural efficiency. They are named as follows, reading from the latest to the most ancient :

(1) Azilian ; (2) Magdalenian ; (3) Solutrean ; (4) Aurignacian ; (5) Mousterian ; (6) Acheulian ; (7) Chellean ; (8) Strepyan ; (9) Mesomian ; and (10) Icenian.

Icenian and Mesomian implements are regarded by some as belonging to the class known as 'eoliths,' the artificial origin of which is seriously doubted by certain authorities. On the other hand, some of the Icenian implements are regarded by distinguished experts as being actually preglacial. The Mesomian implements have, however, at the last moment established their reputation for respectability, and are now described (even by the hyper-sceptical) as being genuine.

It is probable that the Strepyan, Chellean, and Acheulian cultures predominated during the middle inter-glacial period. The Mousterian, commencing in the middle inter-glacial, extends to, and overlaps, the Aurignacian, which must be associated with the last inter-glacial period ; while the Solutrean, Magdalenian, and Azilian carry us into post-glacial times.

There occurs one very wide gap in the history of Palæolithic man in Europe, wider than the breach between the Stone and the Metal Ages, and wider even than that between Palæolithic and Neolithic man.

This apparent solution of continuity occurs between the Mousterian epoch, when *Homo Neanderthalensis* lived in his

caves, and the Aurignacian, which probably occupied the greater portion of the last inter-glacial period.

During the last four Palæolithic epochs—namely, the Azilian, Magdalenian, Solutrean, and Aurignacian—Europe was inhabited by distinct races. Whether these peoples left any progeny to carry on the evolution of the human race, or whether they suffered the fate of extermination, is unknown; but they differed only very slightly from modern man and certainly belonged to the species *Homo sapiens*. Between Mousterian man and modern man there is a wide breach. At times the discovery of the remains of modern man have been reported in strata considerably antedating Aurignacian times; but expert evidence has always gone to show that these hypothetical pre-Aurignacian *H. sapiens* will not stand a rigid scrutiny.

Thus Palæolithic times may well be divided into two portions:

1. An early period, in which four different species of the Hominidæ came into existence, and disappeared—namely (*a*) *Homo Javanensis*, (*b*) *Homo Heidelbergensis*, (*c*) *Eoanthropus Dawsoni*, and (*d*) *Homo Neanderthalensis*.

2. A later period, the greater outstanding feature of which is the total disappearance of all the above species, and in their place the appearance of *Homo sapiens*.

The Aurignacian and his successors constitute essential man; before this we find ourselves among unfamiliar forms, which mark the slow steps of evolution upwards—from the semi-simian precursor to *Homo sapiens* himself.

MIGRATION OF BIRDS

(*Paper read at the Ninth Ordinary Meeting of Members, July* 9)

By V. G. L. van Someren, M.B.O.U. &c.

The subject of the Migration of Birds is an extremely wide one, of absorbing interest, and one about which we know very little.

Ornithologists have been trying to solve its mysteries for many years past, but without much success: the reason of this being due to the fact that there was no co-operation between the workers.

It was not until 1880, when a special Committee was appointed by the British Association, that the matter received proper attention. This Committee gathered together an immense amount of data, but of such a character as to render their report useless to the ordinary field worker. This report has since been carefully worked out by Eagle Clarke of Edinburgh, and is now of extreme value.

Much has been done within recent years to increase our knowledge with regard to the migration of birds within the British Isles, but practically nothing has been placed on record regarding the movements of birds in other parts of the British Empire.

By bringing before you some of the more interesting facts and suggestions that have been put forward regarding migration, I shall hope to interest some of you in the matter, so that within no distant date we shall be able to place on record the accurate observations of bird movements throughout this country.

Early History.—Reference to the movements of birds may be found in the ancient writings of Homer, and many another of the early philosophers, and also in the Bible; but beyond the fact that birds appeared and disappeared, after a short stay, nothing was known.

We read in Professor Newton's 'Dictionary of Birds' that the Indians of the fur-countries, in forming their crude calendar, name the recurring moons after the birds of passage, whose arrival is coincident with the changes.

That certain movements at fixed periods took place was apparently well recognised, but the manner of arrival and departure were matters of conjecture. Thus Professor Newton informs us that the Tartars and Egyptians noted the arrival of large and small birds at the same time; they could understand the larger ones undertaking and accomplishing a long journey, but what of the small species? How did they travel? The conclusion arrived at was that when the birds flocked

together for the journey, each large bird took one or more of its smaller brethren on its back, and so conveyed them to their winter quarters. The story is very pretty, but hardly correct. We now know that even the smallest of migrants depends on its own powers of flight to carry it from one country to another.

The Egyptian peasant still believes that the Cranes and Storks carry a living load.

It is not many years ago that the annual disappearance of certain species of birds from England was put down to the fact that they hibernated during the winter months, as do certain rodents. Specimens even were produced of birds—such as swallows—in more or less a torpid state, as evidence in support of the supposition; but it was recognised that all were birds in poor condition, which through injury or weakness had not been in a fit state to travel with their fellows when the time of migration arrived, and, being unable to procure a sufficiency of food, suffered accordingly.

The supposition, of course, is false; but even nowadays one sees notices in the papers that birds have been found hibernating!

The autumnal migration of birds is well recognised by a certain class of people in the north of France, Belgium, and Germany. These folk are professional trappers and netters, and, knowing the favourite routes by which hundreds of birds pass, set their nets where the birds are known to feed, and so destroy hundreds—nay thousands!—of migrants to supply the markets with food which is totally unnecessary.

Classes of Migrants.—Migrants may be divided for convenience into three classes: Local, Partial, and Passage.

The first may be taken to represent birds which are resident in a country, but which migrate to various parts of that country for one reason or another, such, for example, as search for food, or for nesting purposes. These, strictly speaking, should not be classed as true migrants. An example of this group is the Curlew, which during the winter is found on the coast, but in early spring wanders to the hills and moorlands, particularly of Scotland. Another example is the Snow Bunting, which breeds in the north of Scotland and comes south in winter.

In this country we have even better examples of local migrants —such as the various species of Starlings, Pigeons, and other fruit-eating species, which wander to localities where a fresh supply of food is to be found; and, on a much larger scale, the Black-breasted Kavirondo Quail. This group merges into the next, the Partial Migrants. These are species which are represented in a country throughout the year, but whose numbers decrease, to be later on increased by the influx of birds of the same species from other countries. The Ducks of this country may be taken to represent this group. At certain times of the year (the period of which needs further study), duck abound on Lakes Nakuru and Naivasha in thousands, but the majority disappear to reappear in a few months in similar numbers.

Passage Migrants are those species which migrate from one hemisphere to another, passing through various countries en route.

In the case of long-distance or Passage Migrants it might be suggested that those species which migrate farthest south are those which come from the most southerly portion of their northern range, but in reality the converse appears to hold good; thus we find that birds which come farthest south travel to the most northern limits of their range to breed. Examples will be given later, but one may be given here to illustrate the point. The Curlew Sandpiper, whose northern range is the Arctic seaboard of Norway and Sweden, Russia and Siberia, nests most commonly in Spitzbergen, Nova Zembla, and around the mouth of the Yenesei; yet migrates to East Africa as far south as Cape Town. This is all the more interesting when we take into consideration the fact that the areas where these birds nest is free from snow and ice for two to three months in the year only (N.B., times of arrival and departure of this bird).

That long-distance migration does take place has been proved by the fact that birds marked in their northern range have been recovered far south, even as far south as Cape Colony; for example, a young Stork, marked as a nestling in the north of Holland, was shot just outside Cape Town. Again, amongst the specimens illustrating this paper will be found

birds which breed only in the far north, yet are commonly found in this country in winter.

Now with regard to the causes of migration; nothing definite is known, so we can only put forward suggestions.

Take first of all the autumnal or southward movement. In some cases the increasing scarcity of food may be all-powerful and prove a sufficient reason; for it is well known that birds will travel to great distances in order to obtain food. Thus we find it recorded by a recent observer in Northern Siberia that certain waders disappeared when food—particularly insect life—became scarce, as a result of a fall in temperature.

The limited amount of food in a certain area may account for the fact that in certain species of birds, which are double-brooded, the young of the first brood are driven away by their parents, thus assuring nourishment for the second brood; and in the case of Partial Migrants some birds may move south in the autumn, knowing that if they remained there would not be sufficient food for them and for the large number of immigrants from other countries.

That climatic conditions—such as fall of temperature, increasing rains and wind—play an important part is well demonstrated when we consider the movement of birds in the Arctic zone; yet, on the other hand, we have instances where certain sea-birds, such as Puffins, return to their breeding-grounds on exactly the same date in each year, no matter what the weather conditions are like.

These two causative agents may appear to be sufficient when applied to the southward movement, but what governs the return in spring? Here we fail almost entirely and have to fall back on that much abused term Instinct, which, in other words, may be taken to mean 'love of the country of their birth'! This cannot be proved or disproved.

When considering the return movement of migrants from this country, it is interesting to note that when this movement takes place our local birds are breeding and all conditions appear most favourable. Why don't the migrants remain here to breed? That some individuals, belonging to species well recognised as migrants, do breed in this country is now recognised, but whether these individuals or their young ever do

take part in the migratory movement at any time cannot be proved. It is quite possible that when our knowledge of the nesting-habits of the birds of this country is increased, it will be found that quite a number of European birds remain to breed in some part of Africa. Thus, who can say whether the Great Spotted Cuckoo, which is found breeding in South and East Africa, was at one time purely a winter visitor to these countries and not a resident breeding species? (See examples, adults and young.) Has the bird extended its breeding range, and will the African birds in time become a distinct form? Evidence seems to point this way.

Manner of Migrating.—The manner of migrating is interesting. Some species migrate in flocks of their own species; others in mixed flocks; others, again, travel alone. These three methods are of importance when considering the governing factors regarding routes.

How do the birds know the correct route? What guides them? According to certain observers, each species has its definite route or routes; but the routes of certain species may coincide for part of the way or for the whole distance. Our knowledge on these points is small; thus we find authorities disagreeing.

Manner of Travelling.—It seems to be established that all the birds of a given species and from a given locality do not migrate together and at the one time; thus we find the movement to be wave-like; one batch of birds starting the movement, to be followed at varying interval of days by fresh batches. In certain species the young birds are the first to arrive; in others, again, the adults; then when we consider the return or spring movement, we find that with certain species the males travel by themselves and the females by themselves, and in many of these cases the males arrive at their destination first. Not only do we find this to be the case with some European birds, but we see it also with certain of the Weaver Birds in this country. The males arrive at a nesting-site and begin to weave their nests: the females turn up later and help to finish the work.

Directive Agents.—Several suggestions have been put forward; keenness of vision and recognition of landmarks, high development of sense of direction and locality, and knowledge

of the positions of the magnetic poles. All may be contributory factors, but any single one is not sufficient; thus, taking the point of recognition of landmarks and previous knowledge of the route, we find that in many cases the birds are known to travel by night time, as evidenced by the fact that astronomers have reported the passage of large numbers of birds across the face of the moon, and that these birds are travelling at great heights. Again, we know that flocks of birds are attracted to lighthouses at night in immense numbers. Frequently, also, one can hear large numbers of birds flighting at night time.

It is also a noticeable fact that when one does hear the birds flighting it is usually on a dark still night, especially when there is a mist or when rain is falling. These facts, then, rather put the theory of landmarks out of count to a great extent. Another fact which also contradicts the suggestion of landmarks is that already alluded to in connection with the food supply—namely, that in some species the young migrate first, unaccompanied by any adult bird over routes which they cannot possibly know anything about; and in addition we know that the converse is the case with regard to the cuckoo: here the adults leave first, the young follow later; but how? Do they accompany their foster-parents?

There is one point which must not be overlooked when considering landmarks as a possible guide, and that is that one frequently sees certain birds which have flocked preparatory to migrating, ascending in large numbers towards evening, and, after taking short flights at a great height, returning to the place from which they started. Are these birds merely exercising, or are they getting the direction in which to move off later? Major Meinertzhagen has reported that he came across such a flock one afternoon when he was up in an aeroplane, scouting. He also records the interesting fact that this flock consisted of birds belonging to quite distinct species—such as Rollers, Kestrels, and Bee-eaters.

In support of the statement that birds travel by night, I should like to mention that in a certain locality not far from Nairobi, where I took continuous and careful observations during the autumn and spring movement of 1916–17, I was interested to find that on two occasions certain species appeared

in the very early morning, which species were certainly not in the neighbourhood the evening before.

Other evidence against landmarks is the fact that birds can travel over large tracts of ocean.

Some individuals do get blown out of their proper course and turn up at unexpected places—such, for example, as American species occurring on the *east* coast of Britain.

With regard to the suggestion of high development of sense of locality and direction, one would certainly think that this was well exemplified in the case of 'homing pigeons'; but we are informed by authorities on these birds that the ability to travel long distances without losing their way is purely due to recognition of landmarks.

Routes.—According to the observations of certain Russian and German ornithologists, migration-routes follow more or less horizontal lines, but the configuration of the land influences the routes very largely. Thus birds will follow the course of rivers and skirt mountain ranges.

Of the various routes shown on the map[1] I exhibit, comparatively few interest us directly; for the purposes of this paper it can be taken that the eastern routes are those by which birds come to and go from this country. There are of course exceptions (*cf.* specimens of Swifts and Western Nightingale). Most species, after having crossed the European or Asiatic countries, pass across to Africa, travelling either down the east coast or down the Valley of the Nile, to this country or even on to the Cape.

Rate of Travelling.—The rate at which birds travel while on migration has been calculated by a German observer to be 200 miles an hour. This seems incredible, but may be true for short-distance flights. But could the birds keep this speed up for any time? Experiment shows the rate to be about thirty-eight miles per hour, but this was under artificial conditions. I have no doubt that birds travel at the most favourable time, and that they take advantage of air-currents to help them on.

I shall hope to show later on, by means of actual specimens, that individuals of certain migratory species do not leave

[1] Not reproduced in this JOURNAL.

their winter quarters, but remain here throughout the year. Such birds are probably immature, and, not being in a condition to breed, have not undertaken the journey, but others are certainly old birds which, through lack of condition, have been unable to move off with their fellows.

Uganda and East Africa are extremely well placed with regard to migrants, for through and to these countries come birds from Europe, Asia, and to a less degree West and South Africa.

I shall now confine myself to a few general remarks regarding migration as seen in this country.

The first month in which one may expect to see migrants is in the latter part of July and beginning of August, but the greatest numbers are to be seen in October, and one can count on seeing several species up to the end of March and occasionally till May. As already mentioned, a certain number do not leave this country at all.

The best places to look for migrants are along the banks of rivers and lakes and amongst swampy ground and on the outskirts of forests; and for most waders, along the coast.

I should now like to bring to your notice various examples of migrants—European, Asiatic, and South African—which have been procured in this country, mentioning briefly the countries in which they breed, noting their date of arrival and departure at and from these places and comparing them with the dates of collecting the specimens exhibited.

You will thus be able to realise what a rich country this is for the study and observation of the various aspects of one of Nature's most wonderful phenomena.

1. The Golden Oriole (*Oriolus galbula*) is a spring visitor to England, some few remaining to breed in suitable localities in the southern counties. Principal nesting-areas: countries south of the Baltic. They nest in May and June.

During their northward migration they have been noted to pass through Egypt in April. They have been collected by me in this country between October and April.

During October of 1916, Orioles passed through my garden at Nairobi on their southward migration; some remained for a few days. In November another flock of eleven arrived, most of them young birds. They were seen or heard for a

week. They then passed on. None passed through this place on the northward move, but specimens were collected at Nakuru in March 1913, and a young male was obtained on the western slopes of Elgon on April 18. The Elgon bird which I exhibit is a young male, still in its second plumage, and though presumably migrating north, shows no signs of assuming the full breeding dress. Had it reached its summer quarters it presumably would not have bred.

Care should be exercised, when recording the arrival of young or female birds, not to confuse them with those of *O. notatus*, which they closely resemble.

2. The Tawny Pipit (*Anthus campestris*) has been recorded from East Africa, but specimens were probably wrongly identified. I doubt whether this bird migrates farther south than northern tropical Africa. Local Pipits, very like *A. campestris*, flock just about the time that migrants arrive.

3. The Tree Pipit (*Anthus trivialis*).—Summer resident England and Wales ; breeds in northern half of Europe ; arriving April, leaving September. Migrates to tropical Africa.

The specimens shown include birds taken from October to April. Very plentiful round Nairobi, particularly common at Naivasha, Nakuru, and Kisumu. October birds are much worn and have a mottled appearance, while the April birds are much more uniform and distinctly ochraceous above and below. These birds in worn plumage can be readily distinguished from the next species by having the rump almost uniform, not speckled.

4. The Red-throated Pipit (*Anthus cervinus*) breeds in the north of Russia, Siberia ; arriving end of May, and leaving middle of August. Fair numbers arrived in Nairobi area. In October they were in fair plumage, though adult birds had commenced to moult.

Most had red-brown throats. A series was collected throughout their stay, and showed that most birds were in full winter dress in December, and they then resembled worn specimens of *A. trivialis*, but were more boldly marked.

Up to the time of departure of the majority, in March, none were in full breeding dress. Did they continue their moult while travelling north ?

The last specimen to be seen was collected on April 18. It was solitary, and is in almost full plumage. Apparently, the first sign of coming maturity is the presence of the red throat, followed later by a lessening of the spots on the breast, which area later becomes pinkish brown and the rest of the plumage generally more fulvous.

Flocks pass through Egypt in April.

5. The White Wagtail (*Motacilla alba*) breeds in the north of Europe and in England. Said to breed in Palestine, also breeds in Asia Minor. They arrive in breeding areas in April, leaving in September. Not a very common migrant to these parts ; most birds make their appearance in November and remain till February.

It will be noticed that some males are in entire breeding dress in January, while others collected at end of February are scarcely showing any signs of assuming the summer plumage.

6. The Blue-headed Wagtail (*Motacilla flava*) breeds in suitable localities throughout Europe. Arrives in May and departs in September. Large numbers pass through Egypt, arriving in these parts in October, usually accompanied by the ashy and yellow species.

So far as I could see, there were no adult birds in full dress in the flock that arrived in the Nairobi District last October ; all were young birds and hardly to be distinguished from young *M. raii*. By January some birds had commenced to assume the adult dress, and could then be picked out easily from *M. raii*. In these, as in others of this group, fully two-thirds showed no signs of assuming the adult breeding dress when they left Nairobi in March.

7. The Ashy-headed Wagtail (*Motacilla cinereacapilla*) breeds in the southern portion of Europe. It is not a common migrant to these parts. A few are to be found with *M. raii*. I collected a single specimen in full plumage on April 25—probably a stray bird ; they seem to be more plentiful in the Kisumu district than elsewhere. The series exhibited contains specimens collected between October and April 1916–17.

8. The Black-headed Wagtail (*Motacilla melanocephala*) although not admitted by some authorities as entitled to sub-

specific rank, appears to be quite distinct, and this is supported by its habits when in this country. My experience is that they are not common, that they keep to themselves, not mixing with others of their own family, and that they appear in this country much later on than do other species, and they do not travel so far south.

They breed in the Eastern countries of Europe.

9. The Yellow Wagtail (*Motacilla raii*) is a summer visitor to the western countries of Europe where it breeds. They arrive in May and depart in September. Most go to West Africa, but during the season last year hundreds arrived in the Nairobi district ; in October they were present in large numbers right up to the end of March, and, when they left, scarcely half were in full plumage.

Odd birds were procured by me through April and May.

10. The Grey Wagtail (*Motacilla melanope*) appears to be quite the most rare of this group, few visiting this country. As a summer resident they inhabit the countries from South Sweden to the Mediterranean. I have never seen them in flocks numbering more than four to six individuals ; most frequently they are seen singly. Of the two specimens exhibited one was collected in December, the other as late as June. The latter is not in anything like full plumage.

We now pass on to another group, commonly called Butcher Birds or Shrikes.

11. The Lesser Grey Shrike (*Lanius minor*) is widely distributed, breeding in South and Central Europe, north to Siberia, and east to Asia Minor and Turkestan.

In winter it migrates to tropical Africa, arriving here in October. They can usually be found in pairs or small flocks up to March, but I have also obtained them in April and even in May.

12. The Great Grey Shrike (*Lanius excubitor*). Examples of this species have been reported from this country, but it seems to me very doubtful whether they are the European bird. There are one or two local forms extremely like it which are resident in this country and whose numbers increase at certain times in the year ; but, having collected a very large series, I was unable to find a single specimen which agreed

with the European bird. One specimen, collected at Ankoli in Uganda, was very close, but it was not quite mature.

13. The Woodchat Shrike (*Lanius senator senator*) breeds in the central countries of Europe, east to south Russia and Asia Minor. Most birds of the European form migrate to North Africa and West Africa, but a few come this way. There are local north-east African forms which also migrate to a certain extent, so one has to be careful when reporting the occurrence of this bird not to confuse it with these.

Odd birds are to be met with here from October to March.

14. The Red-backed Shrike (*Lanius collurio*) as a breeding species is found over Europe generally; they arrive in April and leave in August and September. They are quite a common migrant to this country, passing through Egypt in September and arriving here in October; they are present up to the end of March in fair numbers, but last spring they were here till late in April.

Layard reports that they breed in Namaqualand, but this is doubtful.

15. The Isabelline Shrike (*Lanius isabellinus*) breeds in Persia and Turkestan, north to southern Siberia.

I can find no records of dates of arrival and departure at and from these countries. They were plentiful in this country last winter and spring from October to February.

16. The Spotted Fly-catcher (*Muscicapa griseola*) generally distributed over Europe during summer from April to September. They arrive in Nairobi district about the second week of October and remain till third week of March, though some remain on till April.

17. The Willow Warbler (*Phyloscopus trochilus*) breeds in England and Europe generally; arriving in April, leaving in September. This is the smallest migrant to these shores, and is also one of the most common. They arrive here in great numbers in October, leaving again in March and April. Whilst here they frequent practically all types of country, even grass lands, where there are a few odd shrubs. Two other species of this group are reported from this country, but I have not collected them.

18. The Great Reed Warbler (*Acrocephalus turdoides*)

breeds in Central Europe, where it is resident in the summer months from April to September. Fair numbers come here in November and remain till March.

19. The Lesser Reed Warbler (*Acrocephalus strepherus*) as a breeding bird is found over Europe generally, between April and September. At the end of the latter month they migrate, some arriving in this country in October, but most make their appearance in November and leave again in April.

20. The Marsh Warbler (*Acrocephalus palustris*) breeds in England and Europe generally, not including Sweden and Norway. Large numbers come here in November, and are to be found along rivers and swamps up to April; the latest date that I have recorded is May 25.

21. The Sedge Warbler (*Acrocephalus phragmitis*), as a breeding bird occurs over Europe generally, between April and September. It is a very common migrant, arriving in September and remaining till May.

22. The Pallid Warbler (*Hypolais pallida*) breeds in South Europe and South-West Asia, and winters in East Africa, arriving here in November and going north in March.

23. The Barred Warbler (*Sylvia nisora*) is found in Germany, and South Sweden, North Italy, south to Russia and Turkestan. It has rarely been taken in East Africa, December to February.

24. The Garden Warbler (*Sylvia hortensis*) breeds in Europe generally; the southward movement commences in September and continues till October. During last autumn the first arrivals in this country turned up in September; fresh arrivals appeared in increasing numbers till November. Dozens remained in my garden till January, after which they gradually decreased, the last lot being seen on April 5, in this district. Later on, I came across a few birds at Kisumu, in May.

25. The Blackcap Warbler (*Sylvia atricapilla*) breeds in Europe generally, east to Asia Minor, west to Cape Verde, and also in North Africa. They begin to leave their breeding grounds in September, and arrive here at the latter part of that month, and particularly in October. They went north in February and March. At one time during last winter these birds were even more numerous than the Garden Warblers.

26. The White Throat (*Sylvia cinerea*) is found as a breeding species from Scandinavia to the shores of the Mediterranean. They arrive in Europe in April, and leave in September. They are not a very common migrant to these parts, but odd birds may be met with between November and April.

27. The Rock Thrush (*Monticola saxatilis*) has occasionally been recorded from England; but its breeding haunts are confined to Central and Eastern Europe, east to Siberia and China, and south to North-West Africa. During the winter it is one of the commonest migrants to these parts, arriving on the plains outside Nairobi about the second week of October and remaining there in more or less constant numbers up to April.

28. The Common Wheatear (*Saxicola œnanthe*).

29. The Isabelline Wheatear (*Saxicola isabellinæ*).

30. The Greenland Wheatear (*Saxicola leucorhœa*).

The first species is common throughout Europe from March to October; the second breeds on the Continent, but not in England; both are common birds in this country between October and March, the Isabelline arriving first and moving off first.

The third species, which breeds in Greenland, Labrador, and North-East America, has been recorded from East Africa, but it is doubtful. Such birds certainly agree with description of this form, also in size.

31. The Pied Chat (*Saxicola pleschanka*) is found in summer in Southern Russia, Siberia, Tibet, and China. Fair numbers arrive here in September and remain till April.

32. The Whinchat (*Pratincola rubetra*) breeds throughout temperate Europe, arriving during April and leaving in September and October. The birds that arrive here first are young; these arrive in September to be followed by adults and young throughout October. They begin to go north in March, but some remain till April.

33. The Redstart (*Ruticilla phœnicurus*) occurs in England and the Continent during the summer, it migrates south to North Africa, a few coming as far as East Africa.

The only specimen I have seen or collected was shot in January.

34. The Thrush Nightingale (*Lucinia lucinia*) as a breeding species, occurs in the eastern half of Europe, and is the common Nightingale to be met with in these parts in winter. I have collected them between October and March. They sing while here.

35. The Western Nightingale (*Lucinia megarhyncha*).—Confined to England and western half of Continent in summer; these birds migrate to West and North Africa. An undoubted example of this form was shot by me in Nairobi in November. It was apparently a stray bird.

36. The European Swallow (*Hirundo rustica*) is a summer resident in England and Europe generally, from March to October, though some individuals remain through November and December and occasionally throughout the winter. They commence their southward migration in mid-September from England, but specimens have been collected here in early August (probably birds from South Europe); and these are joined on the way by the Egyptian Swallow, which is also a partial migrant and most remain with us until April; but individuals have been taken in June and July, and no doubt some remain with us throughout the year.

37. The House Martin (*Chelidon urbica*) has been noted to arrive in England in March; but most arrive between April and June, and are distributed over Europe generally. The southward migration takes place from September to mid-October generally, but specimens arrive here in October, and have been observed to be leaving in April.

38. The Sand Martin (*Cotile riparia*).—The arrival and departures are similar to the above, but they are much commoner in the winter in these parts than the preceding species.

39. The Swift, European and Chinese (*Apus apus* and ? *Cypselus pacificus*).—The former are resident in England and Europe from April to September. Most birds migrate to the west coast of Africa, but occasionally flocks take the eastern route and arrive here in August and September. The latter arrives and leaves at practically the same times.

40. The European Nightjar (*Caprimulgus europœus*) arrives in England and Europe in May, and leaves in September. Specimens have been recorded from East Africa from October

to March, whilst they pass through Egypt in August and again in March and April, and are then usually in flocks composed of all males or all females.

41. The European Bee-eater (*Merops apiaster*).—A few appear in spring in England, but do not breed. Found nesting in Southern Europe and islands of Mediterranean and North Africa. Migrates south in large numbers, appearing here in September, and remaining in more or less constant numbers until April and early May.

This species migrates to Cape Colony, where it is said to breed. This is doubtful.

42. The European Hoopoe (*Upupa epops*) has been recorded from this country between October and March, and some specimens have been taken in July and August.

The majority of Hoopoes seen here belong to the African forms. It is a passage migrant to England, and has bred, but its regular nesting areas are in Southern Europe, Western Siberia, and Turkestan.

43. The European Roller (*Coracias garrulus*).—In England it occurs chiefly as an autumn vagrant, but sometimes is seen in spring. Nests in Europe from Central Russia to the Mediterranean, and winters in tropical and South Africa, passing south in October and northward in March. It is a common migrant to these parts.

44. The European Wryneck (*Iynx torquilla*) inhabits Europe in the summer and winters in tropical Africa. A typical specimen was collected by the Cozens-Lowe Expedition in February.

45. The European Cuckoo (*Cuculus canorus*) has been recorded as arriving in England in late March, but most arrive in April, and adults leave in August to be followed by the young in September and October. From Uganda we have collected this species from *July* to February, and on East Elgon in *May*.

46. The Great Spotted Cuckoo (*Coccystes glandarius*) is a resident species in Africa, but numbers increased with migrants from north.

47. The Black-winged Stilt (*Himantopus candidus*), although a resident and breeding species in this country, is

also found nesting in Southern Europe. The birds from the north pass the winter in the tropics ; thus the number of birds is increased in this country between October and March.

48. The Avocet (*Recurvirostra avocetta*) is also a breeding bird in this country, but numbers are certainly increased with arrivals from the north in October.

49. The Common Curlew (*Numenius arquata*) breeds in North Britain and North Europe to Asia, in February to June. Migrates south to all parts of Africa, arriving here, especially on the coast, in large numbers in October and remaining till March, when most go north, but some individuals remain here all the year round.

50. The Whimbrel (*Numenius phæopus*) breeds in Iceland, North Europe, and Siberia, wintering in Africa. Makes its appearance here as early as August, and leaves in April ; but with this species also some remain all the year round. Probably these are young.

51. The Great Snipe (*Gallinago major*) breeds in the north of Russia, west to Scandinavia, east to Siberia, and south to Denmark. They are quite common here in winter during December to the third week of May.

52. The Common Snipe (*Gallinago cœlestis*) breeds in Iceland to North and Temperate Europe, and Asia ; comes to this country in October, and remains till March and occasionally April.

53. The Jack Snipe (*Gallinago gallinula*) breeds in the Arctic regions of the Old World, passes south on migration to East Africa. It is not a common bird. I have collected it here from November to February.

54–57. Terns.—Several species winter here—such as the White-winged Black Tern, the Gull-billed Tern, the Sooty Tern, and others ; but I cannot give dates for these, except the first, which come here in large numbers in November, remaining here till late on in May, most of them then being young.

58. The Lesser Black-backed Gull (*Larus fuscus*).—Some may be migrants, but others undoubtedly remain here all the year round.

59. The Landrail (*Crex crex*).—I cannot say when these

birds first arrive, but they have been collected between November and January.

60. The Spotted Crake (*Porzana maruetta*) also occurs here in winter, but dates of arrival and departure are not known. The specimens exhibited were shot in December and January.

61. The Waterhen (*Gallinula chloropus*) probably does not come this length, the birds found here belonging to the local African form.

62. The Common European Quail (*Coturnix coturnix*) has been recorded, but it is difficult to distinguish from the Cape Quail, which is a resident and breeding species in these parts.

63. The Spoonbill (*Platalea leucorodia*) has been recorded. Several Spoonbills have been seen on Lakes Victoria, Naivasha, and Nakuru—probably *P. alba*, but this needs verification.

64. The Glossy Ibis (*Plegadis falcinellus*) occurs in the low country along the basin of the Danube, in South Russia, and some islands of the Mediterranean; they are also resident and breed in this country. The presence of winter visitors requires confirmation.

65. The Common Grey Heron (*Ardea cinerea*) has been reported, but occurrence is doubtful; specimens exhibited are of the local form (*A. melanocephala*).

66. The Purple Heron (*Ardea purpurea*) is resident and breeding here. Numbers may be increased during the winter.

67. Ducks.—Gargany, Shoveller, and Pintail breed in the sub-Arctic regions of Europe and Asia. Visit the lakes in these parts and are most plentiful in November to January.

68. The European Pratincole (*Glareola pratincola*) has been recorded, but these are probably examples of the African forms. They may be met with throughout the year. Specimens exhibited are birds collected November, January to March; and others have been recorded from the Toro Lakes in June and July.

69. The Barn Owl (*Strix flammea*, sub-sp.), which occurs in this country, has been recognised as a sub-species of the European; but this form also occurs in Eastern Europe. It is doubtful whether it is a migratory bird at all.

70. Scops Owl (*Otus scops*) occurs in Europe, especially in the countries bordering the Mediterranean. It apparently wanders to Uganda; but in this country a sub-species occurs (*O. s. ugandæ*), and farther south we have *O. s. capensis*.

71. The Kestrel (*Tinnunculus tinnunculus*) is partially migratory, but numbers are resident in Europe generally. Some certainly migrate to this country in the winter. Fair numbers are to be seen in October, and the latest record which I have is of a bird taken at Kisumu, in April, during which month they commence nesting in Europe.

They are much in evidence during a grass fire.

72. The Lesser Kestrel (*Tinnunculus Naumanni*).—Inhabitant of the countries surrounding the Mediterranean during the summer, and migrating to Tropical Africa in winter. There are local races of kestrels, which are very like this bird in plumage.

73. The Marsh and Montagu's Harriers (*Circus æruginosus* and *Circus cineraceus*) are regular visitors to these parts during the winter, arriving about October and going north in March.

74. The Osprey (*Pandion haliætus*).—Fair numbers visit us from Europe, where they are generally resident. They are particularly common on Lakes Victoria and Naivasha during the winter. They have been collected here in November to March. They are said to breed in these parts.

75. The White Stork (*Ciconia alba* and *C. nigra*). —Several specimens have been taken or seen in England, but they nest in Europe generally and in North-West Africa. Large numbers arrive in this country in October and remain till March. They move about with the swarms of locusts. The Black Stork also occurs during the same months.

76. The Asiatic Dotterel (*Charadrius asiaticus*) breeds in the south of Russia to Turkestan. They arrive in this country in October and remain till March. They are particularly common in December.

77. The Ringed Plover (*Ægialitis hiaticula*), as a breeding bird occurs over Europe generally. It is a common migrant to this country, being found both on inland waters and at the

coast. The earliest record which I have is October and the latest May 28.

I suspect that some birds remain here through the summer.

78. The Golden Plover (*Charadrius pluvialis*) has been reported, but the occurrence of this species here is doubtful.

79. The Grey Plover (*Squatarola helvetica*) breeds in Arctic Europe, Russia, and Asia. Fair numbers are to be seen on the coast between October and March.

80. The Ruff and Reeve (*Machetes pugnax*) breeds in the northern half of Europe and Asia. Is common here in winter from September to March; but I have shot them as early as August and as late as May.

81. The Knot (*Tringa canutus*) is said to breed in the north of the New World and possibly Asia; thus its occurrence here is interesting. I have not collected it, but one specimen has been shot by A. Blayney Percival in December. Whether it is a regular migrant to this country I cannot say.

82. The Turnstone (*Strepsilas interpres*) breeds in Greenland and Arctic regions. A few specimens have been taken in this country. A small flock of four were seen by me at Lake Nakuru, but they were extremely wild.

83. The Sanderling (*Calidris arenaria*).—Greenland and Arctic regions and Spitzbergen have been given as the breeding places of this species. They are common here, along the coast and on inland waters, where there is a sufficient stretch of sand or mud. The earliest record which I have is November and the latest March.

84. The Dunlin (*Tringa alpina*) is a resident and winter visitor to Europe; a few come here between November and January and remain till March.

85. The Curlew Sandpiper (*Tringa subarquata*) breeds in the extreme north of Europe and Asia, from which localities they depart for the south in August. From my records, I find that the first arrivals to turn up here were in August, but just a few. The majority arrived in October and remained in large numbers up to March. Odd flocks of half a dozen birds each were noted, and specimens obtained therefrom during May of this year at Nakuru Lake. In looking at this series it will be noticed that although the majority of birds

are well on in assuming the summer dress by March, yet some of those collected in the latter part of May show little signs of change (*cf.* Stints); indeed, one male, instead of assuming the red-brown feathers of the spring plumage, is still shedding those of the previous year.

86. The Little Stint (*Tringa minuta*) breeds in the north of Siberia and Europe, leaving these districts towards the end of August; they arrive here in fair numbers in October, some birds showing remains of the summer plumage, others in full winter dress. In December and January they begin to assume the spring plumage, but some are very late in doing this; thus amongst the series exhibited there is a male in almost full plumage shot in February; others again, collected in May, show no change. Most May birds are fairly full-plumaged. I cannot say when these birds left Lake Nakuru, but I am almost certain that some would remain there throughout the summer.

87. The Common Sandpiper (*Totanus hypoleucus*) is found over Europe generally, and winters in the Tropics. Some birds are undoubtedly resident in this country, for we have taken a female with newly hatched young, and, again, I have records of specimens being seen at Nakuru Lake in June and July. Fair numbers of migrants come here in September and remain till March, when they disappear.

88. The Wood Sandpiper (*Totanus glareola*) breeds in Northern Europe and Asia. Common migrants to these parts. Most arriving in November and remaining on, apparently, till April and even May.

89. The Green Sandpiper (*Totanus ochropus*), during the summer, breeds in Northern Europe and Asia. It is a common migrant, arriving here early in October and remaining in more or less steady numbers until March; they then may be seen in odd pairs up to May, and once I saw a specimen in Nairobi area in June; it was, however, a bird that had had an injury to its wing, and although able to fly had not gone north.

90. The Greenshank (*Totanus glottis*) breeds in North Europe and Asia, including the north of Scotland. Has been taken here between December and March. Though not having actually shot a specimen, I saw them at Nakuru Lake in December, in small flocks of three to five individuals.

91. The Redshank (*Totanus calidris*) breeds in suitable localities in Europe, Asia to China, and in Iceland. Though some birds remain in some of these localities for the whole year, most migrate south. They are found along the coast, but I have not shot them.

They have been recorded from December to February.

92. The Marsh Sandpiper (*Totanus stagnatalis*) breeds in Siberia and Turkestan. My records and specimens show that this bird occurs here from August to end of May. The May birds are not in anything like full plumage, and I doubt if they would have left for some time, if at all.

The above dates and records are of birds which I have actually collected or seen, and must be accepted accordingly. It is quite possible that with further study and observation the dates given will have to be extended. No exhaustive observations have been made to determine the migration routes, and until this is done we shall not be in a position to make accurate observations of times of arrival and departure.

It is to be hoped that those members who are interested in the subject will in future make special efforts to collect migrants and to keep accurate notes on their movement, and will send in their records for publication in the Journal.

THE GAME-FISH OF MOMBASA ETC.

By E. K. Boileau

II

In my previous notes, in Vol. V., No. 10, of the Journal, I referred to a list of the native and scientific names of the sporting-fish to be met with on our coast, but by an oversight it was omitted from the manuscript, and will now be found at the end of this article.

This list is compiled partly from Mr. Cuninghame's one in Vol. IV., No. 7, and from Günther's book on Fishes. It is submitted with all due deference to scientists in so far as the

classification of the different species goes, but the native names will be found to be those in common use amongst the 'Wa-Vuvi' or fishermen of the coast.

The subjects with which I now propose to deal are:

1. Bait. Native names &c.
2. Tackle.

Bait.—Almost any bright silver fish, from $\frac{1}{4}$ lb. to $\frac{3}{4}$ lb., is readily taken by all species, when trolled behind a sailing- or motor-boat. The most deadly of all is the 'M'kisi' or Common Grey Mullet; about $\frac{1}{2}$ lb. is the best size, but I am of opinion that the heavier 'Kambesi' would take a 1-lb. fish in preference to a smaller one.

The next best bait, and one often preferred to the above by some fishermen, is a small species of Mackerel called the 'Una,' a life-size illustration of which appeared in my last article. This fish rarely exceeds $\frac{1}{2}$ lb., and is a shapely and brilliant little bait, and undoubtedly very deadly, especially for King-fish.

The natives, however, seldom use either of these lures, but confine themselves almost entirely to the small 'Seemu' or Sardine, which, as explained before, they use with a single hook. When this bait is unobtainable a triangular piece of squid is substituted, or any other small silvery fish which can be threaded on to the hook. The young of the Gar-fish (Mtumbo) and the young of the Baracuda make good substitutes when the 'Una' and 'M'kisi' are not in.

Of artificial baits I have had but little experience, but have heard of instances of fish being taken on the Wilson spoon—a long narrow spoon-bait with a flight of triangles and a single tail-hook. It is not likely, however, that any form of artificial lure is capable of proving more deadly than the real article.

Tackle.—The following outfit is recommended:

1 Tarpon rod, 7 feet (steel centred or not, as preferred).
1 Tarpon reel, to hold not less than 300–350 yards.
350 yards Tarpon line, 24-thread.
50 yards fine piano wire.
1 gross swivels (brass).
1 gross triangles (bronze).
2 pairs pliers (combined wire-cutting).

1 gaff (steel).
1 spring balance (100 lb.).
1 rod-butt rest.

There are so many excellent makes of heavy sea rods on the market that it is impossible to say which is the best, but the writer has always used an 'Army and Navy' Dreadnought Tarpon Rod, No. 2, which being made on the principle of an archery bow is practically unbreakable. It has, however, one fault, which should always be looked for when purchasing—the rings are porcelain instead of agate. In this case a clever Cingalese gold-merchant of Mombasa substituted ivory for the porcelain with excellent results.

The length of the rod should not exceed 7 feet.

Reels.—The most universal reel in use is the multiplier of the American pattern, a costly and complicated article and one which, unless the fisherman is well acquainted with its use, leaves much to be desired.

When recently in London, I was shown what appeared to me to be quite the best type of reel as yet placed on the market. Capable of holding 350 yards line, it was fitted with a strong check and a long thumb-break, and the cost was very moderate—about 50*s*. The reel can be obtained of Messrs. Hardy & Sons, the well-known rod-makers of Pall Mall.

Lines.—A 24-thread Tarpon line is about the best to use, and at least 300–350 yards should be on the reel.

The natives of the coast have an excellent dressing for lines which renders them absolutely waterproof and prevents that curse of anglers, i.e. 'kinking.'

This preparation, or rather preparations, for there are two kinds (both, however, giving the same results), is in the first instance the scraped bark of a stunted bush called Mkasiri, in the second the root of a similar bush called Mkoko. In both instances the outer covering is scraped fine and a handful rubbed on the line, which is then allowed to dry in the sun. Two dressings are necessary, when the line will be found to have hardened and assumed a bright red tint. Frequent dressings are subsequently applied until the line becomes almost black and quite waterproof. This preparation completely does away with the tedious operation of washing and drying the

line after use, and, being a vegetable dressing, does not perish it. One, so dressed, was used continuously by the writer for two years.

Hooks and Swivels.—The former, which should always be bronzed and in the form of a triangle, are most serviceable when about the size shown in the illustration. Swivels should be brass, and are also shown to size.

Gaff.—The strongest and widest in the bend obtainable, and should be fitted with a leather cap to prevent rusting when not in use.

Traces.—Traces of piano wire already made up can be purchased, but it is extremely difficult to keep these sufficiently dry in the humid atmosphere of the coast so as to prevent rusting and consequent breakages. The best plan is to make the traces up from the piano wire itself. A good length of trace is about 4 feet, with three swivels; one at the back end, and two midway—the trace being attached to the line by a patent snap-fastener.

List of the Sporting Fish, Mombasa and Malindi Waters

English Name.	Scientific Name.	Family Classification.	Native Name.
King-fish	*Acanthocybium solandri*	*Scombridæ*	N'guru Mtwana
,,	Unknown	,,	N'guru Bowrega
Baracuda	*Sphyræna* ?	*Sphyrænidæ*	Mzio
,,	?	,,	Kasumba (Malindi). Tingesi (Mombasa)
Unknown	*Caranx ignobilis*	*Carangoidæ*	Kambesi
,,	*C. Gymnostethoides*	,,	Koli-koli
,,	*C.* ?	,,	Wai
The Bonito	*Thynnus pelamys*	*Thynnidæ*	Djodari
Tuna (the Yellow-finned)	*Thynnus maculata*	,,	Sahaywa
Pandu	*Scomber Sancti Petri*	*Scombridæ*	Pandu
The Dolphin	*Coryphæna hippurus*	*Coryphænidæ*	Faloosi
The Gar-fish	*Scombresox belone*	*Scombresocidæ*	Mtum-bo
The Sword-fish	*Histiophorus* ?	*Xiphiidæ*	Sulsuli
The Red Bass (?)	*Lethrinus* ?	*Lethrinidæ*	Kiunga or Tisanda

A flight of triangles is attached to the trace. Experience has shown that nothing less than three triangles is of any use, and even with this number the bait is often cut clean in half by King-fish, who are very adept at avoiding the hooks. A few traces should be put together of different sizes to fit the various-sized baits. The illustration opposite is an attempt to describe the type of flight which has proved most successful.

Measurements do not include the length of the triangle itself.

A few of the best fish captured off Mombasa may here be mentioned to conclude this article. Unfortunately the writer has, owing to the war, dropped out of touch with records, so readers who have killed larger fish than those recorded below must pardon the exclusion of the same from these pages.

Kambesi . . .	93 lb., H.E. Sir Henry Belfield
,, . . .	82 lb., Mr. Lee, Audit Office
,, . . .	72 lb., Mr. W. N. McMillan
Koli-koli . . .	64 lb., Mr. Aflalo and Dr. Small
,, . . .	57 lb., Dr. Small.
Baracuda . . .	57 lb., Mr. E. K. Boileau
King-fish . . .	62 lb., Mr. E. K. Boileau
,, . . .	54 lb., Dr. Small
,, . . .	45 lb., Mr. W. N. McMillan
,, . . .	45 lb., Mr. Cunningham.
Yellow-finned Tuna .	35 lb., Mr. E. K. Boileau.

E. K. Boileau,
Lieut. R.E.

Morogoro, G.E.A.
10/10/16.

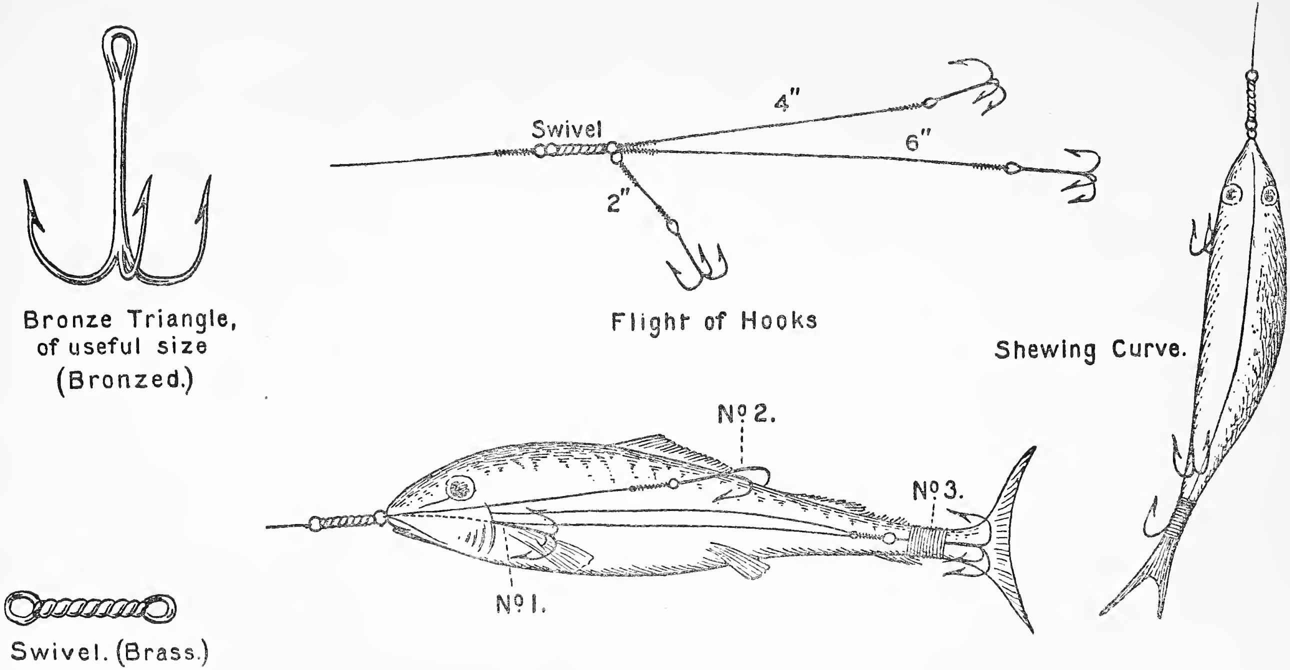
P.S.—I note the presence of King-fish here, both varieties, in great numbers, which supports the theory that these fish travel south on the break of the south-west monsoon.

A curious fact is that, whilst 'N'guru Bowrege' is apparently common here and at Malindi, I have not yet heard of it in Mombasa.

E. K. Boileau,
Capt. R.E.

Dar es Salaam.
21/4/17.

RED BASS, 11 lbs.
Caught trolling at a speed of 8 knots in Mombasa Harbour.



[SKETCH TO ILLUSTRATE METHOD OF AFFIXING BAIT TO TRACE.

NOTE.—The flight is first passed through gill-cover from behind, bringing the short triangle (No. 1) up to the gill-cover. No. 2 is passed over the back and hooked on in such a position as to impart a slight curve to the body. No. 3 is lashed to the tail. The swivel should be clear of the mouth.

GEOLOGICAL EXPLORATION

Northern Frontier District and Jubaland.

By The Editor

Mr. John Parkinson, F.G.S., in 1915, carried out what is believed to be the first attempt at a rapid geological survey of the above area, the journey being undertaken at the request of the Government with the object of obtaining information regarding the water supply of the region. His results may prove of interest to future travellers and prospectors who wish to visit that part of Africa.

Upon his return to England he read a paper before the Geological Society of London, and the following abstract has been published by that Society. His paper was termed ‘ Observations on the Structure of the Northern Frontier District and Jubaland Provinces of the East Africa Protectorate.’

He reports the discovery of a floor of gneisses and schists, among which the Turoka series (recorded from Magadi Railway line) of metamorphosed sedimentary rocks were found at several places; this mass of metamorphic rocks is overlain on the western side by lavas, including those arising from the volcanos Kulal, Assi (‘ Esie ’ of the maps), Hurri, Marsabit, &c., and by probably older lava-fields, which together extend as far as long. 39° E. On the south, it was found that the lavas north of Kenya reached the Guaso Nyiro, leaving *Inselberge* of the crystalline rocks in their midst, but that a high gneiss country extended north-westwards from lat. 1° N. and long. 38° E. to within a short distance of Lake Rudolf. Eastwards the coastal belt of sediments proved to be of Upper Oxfordian Age and to extend to long. 40½° E. (west of Eil Wak), and these were lost southwards under the great alluvial plain of Jubaland.

At intervals throughout the alluvial plain, and lying in hollows in the Jurassic rocks, disconnected exposures were

found of soft calcareous sandstones or limestones (Wajhir, Eil Wak), the age of which cannot now be definitely fixed.

Evidences of the desiccation of the country were, it was thought, shown (1) by the "laks" or water-channels characteristic of Jubaland, which contained surface water only during the rainy season, and then extremely rarely, if ever, throughout their length; (2) by the presence of freshwater molluscs in the scarcely consolidated beds of such laks and at other places where now no surface water is present (Buna and near the Abyssinian frontier); and (3) by the presence of wells along fault-lines and in other places where, but for the previous presence of springs, it appears improbable that the natives would have begun sinking.

The region between Lake Rudolf and Marsabit was pointed out as one of exceptional interest, which the speaker had so far not been able to investigate.

The depression between the Mathews and associated ranges and the Abyssinian frontier on which the Marsabit and Hurri volcanoes were situated, and the origin of the Kuroli Desert (Elgess), were the outstanding features of the district that required further elucidation.

Mr. G. C. Crick stated that the Cephalopoda submitted to him by the lecturer consisted chiefly of crushed ammonites from dark-grey shales at Kukatta on the Juba river (lat. 2° 8′ N.), there being also a belemnite preserved in a yellowish-brown rock-fragment from Serenli on the same river and somewhat north of Kukatta. He regarded all the ammonites as referable to *Perisphinctes* and its section *Virgatosphinctes*, and to species which had previously been described from the neighbourhood of Mombasa. From this assemblage of forms he concluded that the shales of Kukatta were of Upper Oxfordian (Sequanian) Age. He stated that the belemnite from Serenli indicated the presence there of a slender sulcate form, similar to those previously recorded from British Somaliland on the north and from the neighbourhood of Mombasa on the south; but, although of Jurassic age, it was too imperfectly shown in the rock-fragment for accurate determination.

Mr. R. Bullen Newton said that he had examined a small series of non-marine Kainozoic molluscan remains belonging

to recent species, and associated with hard and soft limestones, calcareous sandstones, and conglomerates, which had been collected by the lecturer, and he had determined them as follows:

Ampullaria ovata (?) (Olivier).—Locality—Lak Buna.

Distribution—Recent: Victoria Nyanza, Tanganyika, Nile. Post-Pliocene: Egypt. Miocene: Victoria Nyanza.

Melania tuberculata (Muller) (*curvicosta*, Deshayes).—Localities—Archer's Post, Lak Buna, Chukali Ghofu.

Distribution—Recent: Nile, Rudolf, Nyasa, Tanganyika, India, &c. Post-Pliocene: Egypt and Sahara. Pliocene: Lake Assal, French Somaliland (formerly regarded as Abyssinia). Miocene: Rudolf (Omo river), Greece, North Italy, &c.

Cleopatra bulimoides (Olivier).—Localities—Lak Buna; Chukali Ghofu.

Distribution—Recent: Nile, Rudolf, French Somaliland, Zanzibar. Post-Pliocene: Egypt. Pliocene: French Somaliland. Miocene: Victoria Nyanza.

Bithynia and *Planorbis*, spp.—Locality—Wajhir.

Limicolaria rectistrigata (E. A. Smith).—Locality—Archer's Post.

Distribution—Recent: Rudolf and Tanganyika regions.

Rhachis Rhodotœnia (Martens). Locality—Chukali Ghofu.

Distribution—Recent: Victoria Nyanza and Mount Kenya plateau.

Leptospatha spathuliformis (Bourguignat). — Localities — Turbi and Lak Bana.

Distribution—Recent: Rudolf and Zanzibar.

Corbicula fluminalis (Muller) (*saharica*, Fischer).—Localities—Turbi, Lak Buna, and Chukali Ghofu.

Distribution—Recent: Nile, Rudolf, Marguerite, and Abyssinia. Post-Pliocene: Egypt and Sahara. Pliocene: French Somaliland. Miocene: Rudolf (Omo river beds).

Corbicula radiata (*pusilla* ?), Philippi. Locality—Chukali Ghofu.

Distribution—Recent: Nile, Rudolf, Victoria Nyanza, Albert Edward, Nyasa, Tanganyika. Post-Pliocene, Egypt. Pliocene: French Somaliland. Miocene: Rudolf (Omo river beds).

No vertebrates occurred with these shells, hence their age would probably be younger than the Omo river deposits north of Lake Rudolf, that have yielded a somewhat similar molluscan fauna, but with the addition of *Dinotherium* and other vertebrate remains. The presence of that genus as pointed out by Dr. Haug (' Traité de Géologie,' 1908–11, vol. ii. p. 1727), was indicative of the Pontian or Upper Miocene period. There are, however, some lacustrine beds near Lake Assal, in French Somaliland (formerly regarded as Abyssinia), which contain shells also bearing a resemblance to those collected by Mr. Parkinson in British East Africa, especially *Melania tuberculata, Cleopatra bulimoides, Corbicula fluminalis,* and *C. radiata,* which are common to both sets of deposits. These Lake Assal beds, which are also without vertebrate remains, have been identified by Aubry (*Bull. Soc. Géol. France,* ser. 3, vol. xiv., 1885, pp. 206–209), and Pantanelli (*Atti Soc. Toscana Sci. Nat. Proc.-verb.*, vol. v., 1887, pp. 204–206, and *ibid.*, vol. vi., 1888, p. 169) as of Pliocene age. If, from these facts, such widely distant beds can be recognised as contemporaneous, then the suggestion may be made that the northern half of British East Africa was probably an extensive freshwater region during Pliocene times, limited on the north by Lake Assal, on the east by Suddidima, on the south by Archer's Post and the Mount Kenya plateau, and on the west by Lakes Rudolf, Stefanie, and Marguerite.

Assistance in the determination of these shells has been kindly rendered by Mr. E. A. Smith, I.S.O.

NOTES ON A COLLECTION OF BIRDS FROM LAMU AND DISTRICT, MADE BY MR. H. J. ALLEN TURNER IN APRIL 1916.

By V. G. L. van Someren, M.B.O.U.

The following is a list of the birds collected by Mr. H. J. Allen Turner during his *safari* to Lamu and district. The collection contains 836 skins, representing 128 species, and was made in April 1916.

In some few cases I have been unable to determine the exact sub-species to which they belong, owing to want of material with which to compare them and to lack of literature. Such birds will be sent home for further study.

The entire collection, with the exception of the European migrants and a few examples of African species, has been placed in the Society's Museum and is available for study.

As far as possible the order followed and nomenclature is that of Reichenow in his 'Vogel Afrikas.'

Laridæ

Larus Hemprichi, Bruch. Hemprich's Gull. ♀ 1. Manda Island. A not fully adult bird, showing traces of second plumage. In heavy moult.

Gelochelidon nilotica, Hasselq. Gull-billed Tern. ♀ 1, ♂ 1. Lamu and Manda. The female is in almost full plumage, while the male is in complete winter dress. They were collected within a few days of one another, during April. Wings 315 and 313 mm.

Sterna bergei, Lcht., ♀ 2, ♂ 1. *Sterna media*, Horsf., ♀ 3, ♂ 2. Yellow-billed Terns. Manda Island. These birds are all in winter plumage.

Charadriidæ

Glareola pratincola fulliborni. African Red-winged Pratincole. ♀ 4, ♂ 8. Lamu and Manda. According to Hartert (Nov. Zool. Tring. 1916) the Pratincoles found on the East Coast of Africa as far south as Natal belong to *G. p. fulliborni*. All the birds of this series obtained belong to one species.

Cursorius temmincki, Sw. African Red-capped Courser. ♀ 9, ♂ 7. Coast of mainland. A certain amount of variation in the richness of the coloration on the breast exists, but on the whole the series is uniform. A very young bird, in first plumage, was shot May 11, 1916.

Charadrius Geoffroyi, ♀ 1, ♂ 2. Manda Island. One male is in almost full summer plumage, while the other is still in winter dress. They were collected between April 6 and 9.

Charadrius mongolicus, Pall. ♀ 1, ♂ 4. Lamu and Manda. These birds agree in every way with the description of *C. mongolus,* and not *C. pyrrhothorax.* They have the lateral upper tail coverts white with grey-brown spot midway on the shaft.

Charadrius hiaticula, L. Ringed Plover. ♀ 1, ♂ 3. Mombasa and Manda Island. The males are in full breeding plumage; the wing measurements vary from 122–129 mm.

Charadrius pecurius. Sand Plover. ♀ 3, ♂ 10. Manda Island, M'koi and Lamu. This series included birds in all stages.

Charadrius marginata. ♀ 1, ♂ 1. Manda and Lamu. The male is in full dress.

Squatarola helvetica, L. Grey Plover. ♀ 3, ♂ 2. Manda and Lamu. Although all these birds were collected at almost the same time, they show gradations from full summer plumage to full winter. They were collected in March.

Stephanibyx inornatus, Swains. Lesser Grey-breasted Plover. ♀ 2, ♂ 2. Lamu and M'koi. Wing measurements vary from 160 to 184 mm.

Œdicnemus vermiculatus, Cab. African Stone Plover. ♀ 4, ♂ 6. Lamu. The birds in this series are remarkably uniform in colour and size, with the exception of one quite young specimen.

Dromus ardeola, Payk. Crab Plover. ♀ 3, ♂ 3. Lamu and Manda. An immature female in first dress was collected in April.

Numenius arquatus, L. Curlew. ♀ 7, ♂ 8. Manda Island. The great difference in size between adult males and females is well illustrated in this series. The largest bird has the bill 180 mm. on the straight and the smallest 125 mm.

Numenius phœopus, L. Whimbrel. ♀ 3, ♂ 3. Manda Island.

Terekia cinerea, Guld. Yellow-legged Plover. ♀ 2, ♂ 1. Lamu and Manda. These birds are just coming into full plumage.

Tringoides hypoleucus, L. Common Sandpiper. ♀ 3, ♂ 2. Lamu and Manda. Birds in soiled and dull plumage.

Tringa arenaria, L. Sanderling. ♀ 2, ♂ 8. Lamu and Manda. These birds, collected during the first two weeks of April, show every grade of plumage from the almost full winter to the half summer dress.

Tringa subarquata, Gould. Curled Sandpiper. ♀ 8, ♂ 6. Manda Island. This series, collected towards the end of April, included birds in practically full summer to full winter plumage.

Tringa minuta, Leisl. Little Stint. ♀ 2. Mombasa. Both birds in full winter dress.

Totanus nebularius, Gunn. Green Shank. ♀ 4. Manda and Lamu. One male is in full dress and has the head and neck streaked with black and the breast spotted with triangular marks. It is considerably larger than the others.

Turnicidæ

Turnix lepurana. Butter Quail. ♀ 1. Manda Island.

Ardeidæ

Herodias gazetta. Lesser Egret. ♀ 2. M'koi. A young bird and a fully mature male.

Columbidæ

Vinago Wakefieldi, Sharpe. Coast Green Pigeon. ♀ 1, ♂ 4. Manda Island and Lamu. Wing measurements vary from 145 to 154 mm.

Turtur semitorquata, Rupp. Grey-vented Dove. ♀ 2. Manda Island and M'koi.

Chalcopelia chalcospilos. Green-spotted Dove. ♀ 2. Lamu. Rather paler than birds from the highlands, but not varying in size.

Œna capensis, 1. Cape Long-tailed Dove. ♀ 2. Manda Island and Lamu.

Pternistes Humboldti, Peters. Black-breasted Francolin. ♀ 1. M'koi. An adult male in full plumage.

Francolinus Grantii, Hartl. Grant's Bush Francolin. ♀ 9, ♂ 7. M'koi, Manda, Mombasa, and Lamu. In this series there are no birds which approach the so-called *F. Kirki* in the amount of speckling on the breast and under surface.

Accipitres Falconidæ

Kaupifalco monogrammicus, Tem. Bearded Sparrow Hawk. ♀ 2, ♂ 2. Mombasa and Lamu. All adult birds.

Accipiter minnulus tropicalis. Pigmy Sparrow Hawk. ♀ 1. M'koi. A single specimen which does not differ from birds from Nairobi District.

Melierax poliopterus, Cab. Barred Sparrow Hawk. ♀ 1. M'koi. In almost full plumage.

Circaëtus cinereus. White-bellied Eagle. ♀ 1. M'koi.

Striges

Strix flammea maculata. African Barn Owl. ♀ 1. Manda. An adult bird in fair condition. The under surface is sparingly spotted.

Cuculidæ

Centropus superciliosus. Hackled-neck Cuckoo. ♀ 1, ♂ 5. Mombasa and Lamu. These birds are somewhat smaller than inland birds.

Coccystes jacobinus. Lesser Crested Cuckoo. ♀ 1, ♂ 3. Manda Island and M'koi.

Chrysococcyx cupreus, Bodd. Golden Cuckoo. ♀ 2, ♂ 2. Lamu and Manda Island.

Chrysococcyx klassii. White-breasted Emerald Cuckoo. ♀ 2. Manda Island.

Coliidæ

Colius striatus, sub. sp. (?). White-throated Coly. ♀ 8, ♂ 8. Manda Island, M'koi, Lamu, and Mombasa. The coast Coly is undoubtedly separable from the inland form, being much paler generally, and having a whitish throat. C. Grant notes this in *Ibis*, July 1915, p. 403.

Colius macrourus macrourus ? Red-billed Coly. ♀ 3, ♂ 2. Manda and Lamu. These birds are decidedly paler than birds from Kisumu and Uganda and generally smaller, and are thus nearer to typical *C. macrourus* than to *C. m. pulcher*.

Campothera pallida, Reich. Pale Spotted Woodpecker. ♀ 3, ♂ 4. Mombasa, Lamu, and Manda Island. Somewhat like *C. nubica*, but generally paler and having the white spots on the crown much larger.

Dendropicus fuscescens massaicus, Neum. Massai Pigmy Woodpecker. ♀ 1, ♂ 2. Mombasa and Manda.

Dendropicus Hartlaubi, Malh. Hartlaub's Woodpecker. ♀ 2, ♂ 2. Lamu and Mombasa.

Capitonidæ

Barbatula pusillus affinis, Reich. Little Red-fronted Barbet. ♀ 3, ♂ 5. Lamu and Manda Island. A small race agreeing with specimens obtained inland.

Coraciidæ

Coracias garrulus, L. European Roller. ♀ 1. Lamu. In full plumage.

Coracias caudatus caudatus. Long-tailed Roller. ♀ 1, ♂ 3. Lamu and M'koi. Identical with inland birds.

Coracias caudatus lorti, Shelley. Green-breasted Long-tailed Roller. ♀ 2, ♂ 7. A good series in which the characters are constant in all but one specimen, which appears to approach typical *C. caudatus* in coloration. It is of interest to note that this bird and the preceding were found in large numbers in the same localities.

Alcedinidæ

Ceryle rudis. Pied Kingfisher. ♀ 1, ♂ 1. Manda.

Halcyon chelicuti. Hooded Kingfisher. ♀ 1, ♂ 4. Lamu.

Halcyon leucocephalus. Brown-bellied Kingfisher. ♀ 3, ♂ 11. Lamu and M'koi. These birds are rather darker on the crown than birds from Victoria Nyanza, and have the throat pure white, a large patch of red-brown on the shoulder joint, and a line of the same colour separating the grey of the head from the black of the mantle. They can, however, be matched with a bird from Simba.

Halcyon orientalis. White-breasted Kingfisher. ♀ 2, ♂ 1. Mombasa and Manda Island.

Meropidæ

Melittophagus pusillus cyanostictus, Cab. Yellow-throated Bee-Eater. ♀ 3, ♂ 8. Lamu and Mombasa, M'koi. C. Grant states, *Ibis,* 1915, that the type locality of Cabanis' bird is Mombasa. These specimens, therefore, must belong to *M. p. cyanostictus,* and not *M. p. Sharpei,* Hartert. Birds from Nairobi and farther inland are paler on the under surface, and have the blue superciliary stripe distinct and extending well on to the forehead and joining its fellow of the opposite side. These birds are not *M. c. meridionalis.*

Merops superciliosus. Green Bee-Eater. ♀ 12, ♂ 15. Lamu.

Merops nubicus. Carmine Bee-Eater. ♀ 6, ♂ 6. Mombasa and Lamu. Birds in first plumage were obtained.

Upupidæ

Rhinopomaster schalowi, Neum. Slender-billed Wood-hoopoe. ♀ 2, ♂ 4. Manda Island and Mombasa.

One male from Manda Island is abnormal in that the amount of white on the wing extends to all the secondary coverts, and many of the lesser coverts are greyish.

Caprimulgidæ

Three specimens were obtained, referable to *C. fossei, C. frenatus, C.* (?).

Cypselidæ

Tachornis parvus mychrous, Reich. Palm Swift. ♀ 4, ♂ 3. Lamu. These birds appear to be identical with birds collected at Morogoro, G.E. Africa.

Hirundinidæ

Hirundo æthiopica, Blanf. Red-fronted Swallow. ♀ 6, ♂ 7. Mombasa, Lamu, and Manda. This series shows birds

in all stages from young just from the nest to fully adult birds. Average wing measurement 108–110 mm.

Muscicapidæ

Bradornis pallidus murinus, Finsch. Lesser Grey Shrike Fly-catcher. ♀ 8, ♂ 13. Mombasa, Manda, M'koi, and Lamu. Similar in coloration and measurements to birds procured in North Kavirondo and Kisumu, distinct from others obtained on Elgon, Kisumu, and Naivasha to Nairobi—these latter being larger and greyer.

Muscicapa griseola. Spotted Fly-catcher. ♀ 3, ♂ 1. Mombasa.

Batis puella, Rchw. Lesser Pied Fly-catcher. ♀ 1, ♂ 4. Mombasa. The female shows a slight wash of brown on the chin.

Batis orientalis, Heugl. ♀ 1, ♂ 1. Manda and M'kio.

Tchidrea suahelica, Reichw. Paradise Fly-catcher. ♀ 1, ♂ 3. Mombasa, M'koi, and Manda Island. The males seen and procured were all of the grey-and-white form. No brown specimens were observed.

Laniidæ

Pomatorhynchus senegalus. White eye-browed Bush Shrike. ♀ 4, ♂ 8. Mombasa, M'koi. No specimens were seen on the islands.

Pomatorhynchus Jamesi mandensis. Striped-headed Bush Shrike. ♀ 2, ♂ 8. Manda and Lamu. Birds from Manda agree with those from Lamu. They are pale greyish on the head and on the under-surface of the body.

Nicator gularis, Finsch. Brown-throated Olive Shrike. ♀ 1, ♂ 1. Manda Island.

Chlorophoneus sulphureapectus chrysogaster. Orange-breasted Shrike. ♀ 3, ♂ 7. Manda Island and M'koi. On the whole a much brighter bird than those found inland, but certain specimens from Kisumu come very near to being just as intensely coloured.

Laniarius funebris. Black Shrike. ♀ 4, ♂ 3. Manda Island and M'koi. Wings vary from 83–92 mm.

Laniarius sublacteus. Lesser Pied Shrike. ♀ 1, ♂ 2. Mombasa and M'koi.

Dryoscopus affinis. Coast Puff-backed Shrike. ♀ 5, ♂ 9. Lamu, Manda Island, and M'koi.

Melanonotus hypopyrrhus. Grey-headed Giant Shrike. ♀ 5, ♂ 14. Manda Island and Lamu. The amount of chestnut on the breast varies in intensity, as also does the size of the bill.

Lanius caudatus. Long-tailed Shrike. ♂ 6. M'koi.

Lanius minor. Lesser Grey Shrike. ♂ 1. Manda.

Lanius collurio. Red-backed Shrike. ♂ 2. Manda Island and Lamu.

Dicruridæ

Dicrurus afer assimilis. Drongo Shrike. ♀ 3, ♂ 5. Lamu and M'koi.

Oriolidæ

Oriolus roletti, sub-species. Black-headed Oriole. ♀ 3, ♂ 10. Lamu and Manda Island. These birds are uniformly smaller than birds of inland districts, and have wing measurements of 123 mm., as against 130–142 of Nairobi and Uganda specimens. Their call is distinct from that of inland birds.

Sturnidæ

Buphaga erythrorhyncha. Red-billed Ox-bird. ♂ 3. M'koi and Lamu.

Cinnyricinclus Verreauxi. Verreaux' Purple Starling. ♀ 1. M'koi.

Lamprocolius melanogaster. Black-bellied Starling. ♂ 5. M'koi and Manda Island. A young male in partial moult was procured April 22, 1916.

Ploceidæ

Ploceus kersteini. Yellow-breasted Black Weaver. ♀ 1. Lamu. Very few seen. The specimen obtained is in fresh plumage.

Ploceus melanoxanthus, Cab. Black-backed Weaver. ♀ 5, ♂ 11. Lamu, Manda Island, and Mombasa. Some youngish males are very near to *P. nigricollis* in colour of the mantle, which is olive black instead of velvet black.

Ploceus nigriceps. Black-headed Weaver. ♀ 1. Mombasa.

Ploceus bojeri. Coast Golden Weaver. ♀ 3, ♂ 11. Manda Island, M'koi, and Mombasa. The colour of the head varies considerably in the males, as also does the half-collar on the upper breast.

Pyromelana flammiceps. Red-mantled Whydah. ♀ 5, ♂ 2. Mombasa and M'koi. All the birds are in partial moult.

Urobrachya Hildebrandti, Sharpe. Coast Red-shouldered Whydah. ♂ 2. Mombasa. In off plumage. These birds have wings of 92 mm.

Spermestes scutata. Lesser Green-headed Manakin. ♀ 3, ♂ 6. Manda and Lamu. These birds lack the purplish green spots on the flanks found in *S. cuculatus*.

Hypargos niveoguttatus. Black-bellied Fire Finch. ♂ 1. Mombasa. A male in full breeding plumage.

Pytelia melba. Fire-throated Finch. ♀ 2, ♂ 4. Lamu and Manda Island. The red of the throat is very limited, not extending on to the upper breast except in one brightly marked specimen in which the red extends well on to the breast.

Estrilda minor. Lesser Grass Finch. ♀ 1. Mombasa.

Lagonosticta brunneiceps. Fire Finch. ♀ 1, ♂ 1. Mombasa. Not so brightly coloured as inland birds.

Lagonosticta rhodoparia. Rosy-headed Fire Finch. ♂ 1. Mombasa. This specimen is rather worn.

Uræginthus bengalus, Sp. Coast Crimson-eared Grass Finch. ♀ 3, ♂ 5. Manda, Mombasa, and Lamu. These birds are much bluer than birds from up-country and have the crimson ear-spot much more limited in size. The females have the cheeks and throat washed with blue, thus differing from *U. b. brunneagularis*.

Vidua serena. Pin-tailed Whydah. ♀ 2, ♂ 4. Lamu and Mombasa.

Passer gongonensis, R. Coast Sparrow. ♀ 3, ♂ 13. Mombasa, Lamu, Manda Island, and M'koi.

Poliospiza Reichenowi. Reichenow's Yellow-rumped Grey Serin. ♀ 2, ♂ 3. Manda and Lamu. These appear to be similar to up-country birds.

Serinus icterus. Grey Checked Serin. ♀ 1, ♂ 3. Mombasa, Lamu, and Manda. All possess grey cheeks, the grey extending to sides of the head on to the nape. They are distinct from *S. icterus barbatus.*

Anomalospiza imberbis. Thick-billed Weaver Finch. ♀ 1, ♂ 1. M'koi. A pair of these rare and interesting finches was procured; they agree with specimens procured at Kisumu and near the Athi River.

Motacillidæ

Motacilla Raii. Yellow Wagtail. ♀ 8, ♂ 16. Lamu. Birds in all stages of plumage were obtained up to the end of April.

Anthus Nicholsoni. Slender-billed Pipit. ♀ 2, ♂ 4. Manda and Lamu.

Anthus rufulus cinnamomeus. Buff-breasted Pipit. ♀ 8, ♂ 13. Manda, Lamu, and M'koi.

Macronyx croceus. Yellow-breasted Lark. ♀ 1, ♂ 2.

Mirafra Fischeri, Reich. (?). Coast Castenet Lark. ♀ 2, ♂ 3. Lamu and Manda Island. Rather pale birds.

Pycnonotidæ

Phyllastrephas mombasa, Shell. Mombasa Yellow Bulbul. ♀ 2, ♂ 1. Lamu and M'koi. It is interesting to note that birds from Nairobi district referred to in this species are rather larger and more brightly coloured than coast birds.

Phastrephas placidus, Shell. Grey Bulbul. ♀ 3. Lamu and M'koi.

Andropadus insularis, Hartl. Coast Olive Bulbul. ♀ 3, ♂ 5. Mombasa, Lamu, and M'koi.

Pycnonotus barbatus miorus. Yellow-vented Bulbul. ♀ 1, ♂ 2. Mombasa.

Zosteropidæ

Zosterops lateralis, Reich. Pale-breasted White-eye. ♀ 3, ♂ 4. Lamu and Mombasa. So far as I can ascertain, these birds are identical with birds of Kenia district and those found in Nairobi. Reichenow refers Manda and Lamu birds to this species.

Nectariniidæ

Anthreptes hypodilla, Jard. Yellow-breasted Sunbird. ♀ 3, ♂ 4. Mombasa, Lamu, and Manda.

Chalcomitra acik æquatoralis, Reich. Red-throated Sunbird. ♂ 1. Mombasa. I was surprised to find that this specimen belonged to this species, and not to either *C. Hunteri* or *C. gutturalis.*

Chalcomitra Verreauxi Fischeri, Reich. Fischer's Grey Sunbird. ♀ 4, ♂ 5. Manda Island.

Chalcomitra Kirki, Shell. Kirk's Black Sunbird. ♀ 5, ♂ 7. Mombasa, Lamu, and Manda Island.

Cinnyris albiventris, Strickl. White-bellied Sunbird. ♀ 4, ♂ 10. Manda Island and Lamu.

Cinnyris microrhynchus, Shell. Lesser tricollared Sunbird. ♀ 2, ♂ 5. Mombasa, Lamu, and Manda Island.

Sylviidæ

Cisticola semifasciata, Reich. (?). Pallid Grass Warbler. ♀ 3, ♂ 4. Manda Island, Lamu, and Mombasa. Somewhat like the next species, but paler.

Cisticola lugubris (?). Brown-headed Grass Warbler. ♀ 2, ♂ 2. Mombasa and Lamu.

Apalis avocincta, Shp. Grey-headed Tree Warbler. ♀ 1, ♂ 2. Lamu and Manda Island.

Prinia mystacea (?). White-eyebrowed Grass Finch. ♀ 3, ♂ 2. Mombasa and Manda Island.

Sylvietta Fischeri, Reich. Fischer's Bush-creeper. ♂ 2. Manda. A pale bird without any greenish wash on the mantle.

Sylvietta minima, Grant. Coast Green-backed Bush-creeper. ♀ 2, ♂ 2. Manda. A small species having the mantle washed with a decided green.

Cameroptera pileata, Reich. (?). Pale-bellied Wren Warbler. ♀ 2, ♂ 4. Manda and Lamu. This is a small species having the head brownish, the mantle green, and the under surface creamy, with the flanks washed with greyish. It is distinct from inland birds.

TURDIDÆ

Turdus tephronotus, Cab. Streaky-throated Thrush. ♀ 7, ♂ 10. Mombasa, Lamu, Manda, and M'koi.

Crateropus squamulatus, Shell. Scaly-feathered Babbling Thrush. ♀ 1, ♂ 4. Mombasa, Lamu, and Manda.

Argya rubiginosa Heuglini, Sharpe. Brown Babbling Thrush. ♀ 5, ♂ 7. Mombasa, Lamu, and Manda.

Geocichla Fischeri (?). Buff-breasted Babbler. ♀ 1. Lamu.

Cossypha Heuglini, Hartl., *rufescens* (?). Rufous-breasted Cossypha. ♀ 3, ♂ 2. Mombasa and Lamu. These birds are distinct from birds of Nairobi district. Their call note and song is distinct.

Cichladusa guttata, Heugl. Spotted Babbler. ♀ 3, ♂ 5. Mombasa, M'koi, Lamu, and Manda.

Erythropygia leucoptera, Rupp. Pale-breasted Babbler. ♀ 2, ♂ 1. Lamu and Manda.

KIKUYU 'ITHATHI'

BY H. R. TATE

The two Museum specimens of the above were obtained in Fort Hall district, but it was impossible to ascertain their origin or original owner, as those who once knew have either forgotten or refuse to disclose the information. The larger of the 'ithathi' (singular, 'githathi') is a circular piece of

red rock perforated in the centre, 16 inches in circumference and $4\frac{1}{4}$ inches in diameter. The smaller is more of a cylindrical shape, though one end tapers considerably; it is also perforated,

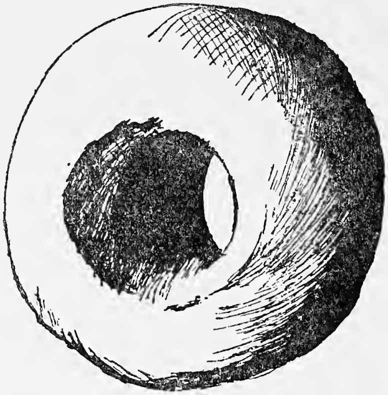
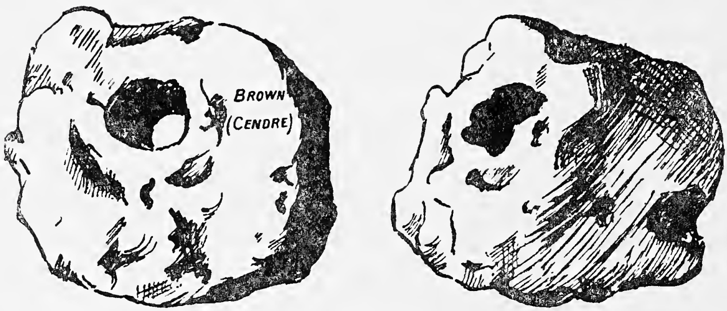


FIG. 1.—REDDISH BROWN STONE.



FIGS. 2 AND 3.—BROWN VOLCANIC ROCK.

and appears to be a piece of volcanic rock pierced lengthwise by artificial means. Height 3 inches, breadth $3\frac{1}{2}$ inches, length $3\frac{1}{4}$ inches, circumference $11\frac{1}{2}$ inches. My Kikuyu informants are of opinion that the larger 'githathi' has been perforated by a native blacksmith, and there is no reason to suppose that it was formerly either the head of a stone or the weight of a digging stick.

'Ithathi' are (or were) used in the Kikuyu ceremony known as 'ku-ringa githathi,' literally 'to strike the githathi,' i.e. to swear a solemn oath on a magic stone.

I first obtained particulars of this ceremony in Kyambu District in 1909, and they appear in my article on 'Kikuyu Native Law' in the *Journal of the African Society.* I had not then been able to obtain a specimen of a 'githathi,' which I was informed was kept hidden away in a cave or hole in the rocks by the few natives owning such stones, but the ceremony as described to me was as follows:

When a native wishes to invoke vengeance upon an offender who may have refused to pay a particular debt, or compensation for an offence against tribal law, or who has been guilty of cheating or fraud, he invokes the aid of the 'ku-ringa githathi' ceremony, which is in this case a commination service, and not an ordeal. Two sticks of the 'mugeri' tree are stuck into the ground, and the 'githathi,' which is brought to the ceremony carefully wrapped up in dry leaves, is poised between. The elder conducting the ceremony stands in front of the 'githathi' and lays a switch of 'mugeri' thereon, invoking vengeance upon the offender at the same time. The words used are 'Arorio ni muma uyu wa githathi,' 'May he be eaten by this curse (or oath) of the githathi!' The ceremony is a public one, all the elders of the neighbourhood being present, and three goats (given by complainant) are eaten. The ceremony is conducted in an open place or under a tree, and the 'githathi' is housed inside a temporary grass booth. The oath has to be repeated every day for seven days, meat and other refreshment being consumed by the elders daily. After seven days the elder who has conducted the ceremony has his head shaved, and, a fourth goat having been killed, he wears a piece of the skin on his wrist as a charm. Owing to the fact that after conducting this commination service an elder may not have intercourse with his wives for three months, complainant generally engages an aged man for this purpose, he himself providing the goats. These two eat the fourth goat. The ceremony is concluded by the sacrifice of one more goat, and the elder who has conducted it finally spits on the ground to indicate that he spews out the curses which he has

invoked on another in order that they may not recoil on to his own head.

The offender who is the subject of the commination dies in a few months unless he puts himself right by paying the compensation demanded of him. My three informants, Kikuyu elders, all knew men personally who died after being cursed.

Mr. Hobley, in his ' Akamba and other East African Tribes,' describes a trial by ordeal with a ' githathi ' at which he was fortunate enough to be present in person. It is evident therefore that the ' githathi ' was (and probably still is) used by the Kikuyu as a means of cursing a tribal defaulter and available for use by the latter if he consented to submit his case to trial by ordeal.

In the latter case the accused man at a largely attended public ceremony swore on the ' githathi ' by holding up the latter by means of two twigs held in his left hand and placing another twig on the burnt clay tube which is used as a ' githathi ' in South Kikuyuland and swearing his innocence thereon. The procedure adopted by him was to discard from his right hand a twig at the end of each declaration. Thus ' If I killed the persons of whose death I am accused ' (naming them), ' may the " githathi " kill me.' ' If I went to Embu to buy medicine, may I die, &c.'

Purification from contact with the 'githathi ' was afterwards effected by accused rubbing a little china clay on his hands, and also eating a little of the same, those present rubbing their feet in the contents of the stomach of a slaughtered goat before leaving the place.

The accused, I am glad to say, did not subsequently die, but enlisted as a policeman.

The Hon. Charles Dundas, in a recent article on the Kikuyu in the *Journal of the Anthropological Institute,* states that home-made ' ithathi ' are sometimes used, but are naturally not much respected. He mentions a famous ' githathi ' owned by a Kikuyu who inherited it from his father, who claimed to have found it in his hand one day when he awoke from sleep. It was apparently a piece of petrified wood.

To-day Kikuyu elders profess to be sceptical as to the power of the ' githathi,' and state that its possession was utilised

formerly by unscrupulous owners as a means of gaining profit and notoriety. These men, however, would not handle the two 'ithathi' presented by me to the Museum, and their attitude is that of a superstitious European to whom the breaking of a looking-glass or the sitting down to table as one of a company of thirteen constitutes the running of a risk which every consideration prompts such a one to avoid.

Nevertheless, the Kikuyu are becoming detribalised so rapidly that superstition is dying fast, and I doubt whether in another ten years it will be possible to witness a ceremony such as that seen by Mr. Hobley in the Kyambu District.

STONE BOWL FOUND IN SOTIK

By C. M. Dobbs

While at Sotik Post, about forty-five miles as the crow flies from Kericho, Lumbwa District, in July of 1917, a native brought me a stone bowl very similar in appearance to the bowl discovered in the same locality by Mr. Duirs and described in Journal No. 8, Vol. IV. p. 145. Just below the Government Bungalow at Sotik, and about a quarter of a mile away, there is a small stream, dry except in the rains, called the Konjosio, both banks of which are used as a salt-lick by the natives. This stream runs through a very deep nullah, narrow at the bottom and widening out towards the top. Apparently, when the salt-lick first began to be used, the natives dug the earth away at the bottom; and by degrees, as the roofs of these artificially formed caves fell in, they went on digging higher and higher up and farther and farther away from the stream. Most of the salt earth is now excavated from caves quite close under the surface soil and far from the stream and well above it. It was while he was digging on the side of one of these caves about 10 to 12 feet below the surface, that a native discovered this bowl embedded in the hard salt earth, and when

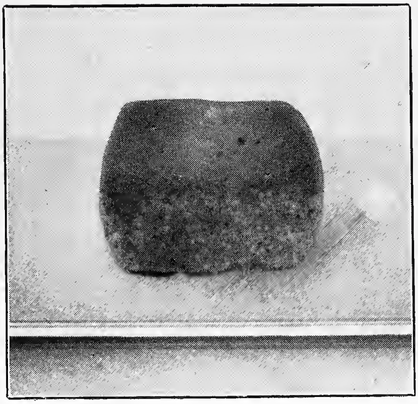
he struck it with his hoe he thought it was a stone and unfortunately chipped a large piece off the side and also scraped the bottom. The bowl seems to have been hollowed out of a sort of soft stone. I do not think that it could possibly be any kind of earthenware, as it is not burnt, and I do not think unburnt pottery could have lasted as it has done. I have asked many old men about it, but one and all declare that they have no idea what it is or where it came from, and state, further, that the stone from which it is made is not known to them. Unfortunately, shortly after the discovery the roof of the particular excavation in which the bowl was found fell in, owing to the rains bringing down a whole mass of roots and rubbish, and in consequence I could not locate the exact spot. It was not, however, a very deep cave, and the bowl was found near the entrance. The dimensions of the bowl are as follows :—

Circumference at widest . . .	23 ins.
,, ,, lip . . .	21½ ,,
,, ,, base . . .	21 ,,
Inside diameter of lip . . .	6½ ,,
Diameter of base	6 ,,
Depth at the centre inside . .	3½ ,,
Height	5½–6 ,,
Greatest thickness about . . .	2 ,,
Weight a little over	6 lb.

WAR IN THE AIR

By R. E. Dent

The following interesting occurrence was observed by me near Kyambu. After three days of heavy rain a flight of white ants in the winged stage took place on September 22, 1916, and, while watching several species of birds feeding on the termites, I noticed several of the latter suddenly fall to earth. I marked one down and proceeded to investigate the cause,



STONE BOWL.

and to my surprise found it struggling on the ground with a brownish yellow fly, about the size and shape of a house-fly, clinging to the under side of its body. This fly continually got its legs round the ant's wings and held it; it appeared to be sucking the upper part of the abdomen where it joins the thorax.

I noticed several specimens of the fly similarly preying on these insects. One of the flies would come up behind an ant, quickly turn upside down and fasten on its quarry. I have recorded this occurrence because I have not heard that any other observer has noted it. The point that puzzled me was that the fly did not appear to possess a proboscis for piercing, but only a sucker. I was also surprised to find a fly so lively on a cold, rainy morning.

I have sent what I believe to be a male and a female to the Museum for identification.

[*Note.*—The Government Entomologist is of opinion that this predatory insect was an Asilid or robber fly.—Editor.]

THE SIRIKWA

By C. M. Dobbs

Some considerable time ago the country where the Lumbwa or Kipsikis are now found was inhabited by a tribe called the Sirikwa. It is very hard to discover at what actual date they lived here, as all that the present generation know about them has been learnt from previous generations of old men, but I am inclined to think that they do not date back very far. They are stated to have resembled in certain ways the Watende, and when they left the present Lumbwa country to have gone across the Sondu River close to Ngoino Hill towards Kisii. This tribe has left many marks behind in the shape of large circular holes in the ground which are found all through the

district from the Nyando River to Sotik. There is also a cairn of stones on a hill in the Nyando Valley which is attributed to the Sirikwa. The holes, which are cup-shaped, are generally found in groups on the sides of small hills, as many as ten or twelve being often found together. They all have a sort of gate or passage leading from the hole on the side away from the hill. The holes vary in size, but are all much wider at the top than the bottom. The dimensions of the largest one I have measured were as follows: Circumference on top at the edge of the hole, 145 yards. The sides sloped down for about 30 feet to the bottom, which was 45 feet in diameter. The actual perpendicular depth was 22 to 25 feet. The passage leading away from the hole was 20 yards wide at the top. This also narrowed considerably as it sloped to the bottom. The natives say that they frequently dig up bits of old earthen pots in these holes, and I myself found many small pieces. These bits of pottery are of a reddish colour and about $\frac{3}{4}$ of an inch thick. Several natives vouchsafed the information that these earthen pots had ears or handles which are not found on any pots that I have seen in this country. I have never seen a piece of a pot sufficiently large to give one any idea whatever of the original shape. I had some excavations recently made in one of these holes in Buret and the only thing discovered was a large bit of clinker, probably a relic of one of the native smiths, who used to do a thriving trade in making spears in the olden days. How these pits came into existence and what they actually were has always been a puzzle to me, and the explanation given by the natives is somewhat extraordinary. They say that the Sirikwa used to keep their cattle in one kraal for a very long period, and that in the course of time, as the cattle churned up the soil into mud, and this was regularly removed, a depression resulted which grew larger and larger. This explanation would also account for the sunken paths leading to these holes, but against it is the fact that there is no raised ridge round the hole which one would expect to find if the soil had been taken out of the hole and deposited on the side. The edge of the hole is practically on the same level as the surrounding country I believe the native explanation is quite a possible one, as it

is remarkable how quickly the ground becomes hollowed out if a number of cattle are kraaled continually in a confined space. Still, the condition of cattle kraaled in a hole 20 feet deep with a rainfall of between 70 and 80 inches per annum must have been somewhat terrible. Beyond these holes and the bits of pots I have never been able to find any other trace of these people except the single cairn above the Nyando Valley.

COW ELEPHANT WITH CALF

By C. M. Dobbs

In March 1909 I was out elephant-shooting in Kisii District, and came one afternoon on a large herd of elephants in some very thick jungle. I succeeded in picking out a bull and shooting him. He fell down, and the rest of the herd stampeded down the hill. On going up to inspect I noticed that in falling he had bent over a large quantity of the tall elephant grass and bush that grew so thickly about, and inside this there was a curious noise going on, as if some small animal was imprisoned and trying to get out. A sudden exclamation from my gun-bearer caused me to look up, and I saw a single cow elephant tearing up the hill straight towards me from the retreating herd. I got away as quickly as I could and hid behind a patch of grass at some distance from where I could see what was happening without being seen. When the cow reached the carcase of the dead bull she started pulling away the grass and bush that had been bent down, and in a few seconds out rushed a small elephant calf, when mother and child quietly trotted off down the hill together after the rest of the herd. Apparently the bull in falling had pulled the grass over the small calf and thus prevented it from following the cow.

NOTES ON THE COLLECTION AND PRESERVATION OF NATURAL HISTORY SPECIMENS

By the Curator

Mammals.—Should be skinned and the skull removed from the body ; skull may be either left in the open for ants to clean, or dropped into sawdust, which will dry it (it can be cleaned later at the Museum). Skins without skulls are of little value. Borax, alum, or arsenical soap may be rubbed on the skin, and camphor or naphtha kept with it to prevent inroads of moths or mites. Place box where ants cannot get at it.

Birds.—The body should be removed, the neck turned inside out ; when the skull is reached the back of same should be cut off so as to expose the brain, which must be scooped out. After skinning up and removing the eyes with great care, the cavities should each be filled with cotton wool, head reversed, and then the body filled with wool ; a paper collar can be placed around the wings, rendering sewing up unnecessary, as the skin will dry. Best to skin from under right wing, but the incision may be made down the breast, and is easier.

Reptiles.—In killing these it is important not to damage the head ; one blow on the back will kill the average snake. Both snakes and lizards readily succumb to chloroform. Lizards should not be caught by the tail, as they readily part with that appendage. The specimen, if over six inches in length, should have several small cuts in the under surface to allow the formalin to permeate the viscera. In snakes over a foot long it is well to remove the internal organs through these cuts. Small reptiles are wanted more than large ones, as the latter are well known ; small burrowing snakes may prove to be new species.

Shells.—Should be dropped into boiling water to kill the mollusc, which can then be removed with a pin ; the empty shells can be packed in cotton wool.

Insects.—Butterflies should be pinched in the thoracic region whilst in the net to prevent them struggling and injuring themselves ; this may be repeated to kill them, or they may be dropped into a killing-bottle. They should afterwards be placed in envelopes and in a day or two stored in an air-tight tin. Moths may be put into killing-bottles and when dead pinned through thorax and pinned into a box. Beetles are best killed (unless finely coloured) by dropping into boiling water, then dried, twisted into a screw of paper, and stored in this. Ants are wanted badly ; a dozen or two from each nest should be killed and put into envelopes, taking care to keep those from different nests separate. Nearly all other insects may be killed in a cyanide killing-bottle and afterwards twisted up in a screw of paper.

Important.—If the locality and date of capture is with each specimen or any notes on its habits, its value and scientific interest is increased tenfold. An easy method is to keep a notebook and number each specimen or give one number to all specimens collected in the same place on the same day.

Where to send.—Specimens should be sent to :

The Curator,
The Museum,
Nairobi.

THE EAST AFRICA AND UGANDA NATURAL HISTORY SOCIETY

ANNUAL REPORT, 1916

By the Honorary Secretary

The Society has now been in existence for eight years, and on the whole has shown distinct though slow progress.

Owing to the continuation of the war throughout the year, the Society has suffered both as regards the falling-off of members and financially. During the year two members resigned, and twenty failed to renew their subscriptions.

It is gratifying to note, however, that several new members have joined during the last six months, so that our total membership is not below that of 1915, viz. 125, as compared with 108.

Many members no doubt have failed to renew their subscriptions owing to the fact that they are on active service, but others probably have not done so simply through forgetfulness.

It is desired to remind members that the Society will become exactly what they choose to make of it. It is only by our united efforts that we shall be able to raise the Society to the position of being a recognised institution. It is not sufficient to leave the 'building up' to a few energetic and keen members; all are urged to take their share, whether by contributing specimens, giving lectures, or helping financially.

Journals.—During the year two journals have been issued, both being quite up to the high standard of preceding numbers. We take this opportunity of thanking those who have contributed to the pages of the JOURNAL and so helping on the Society.

The thanks of the Society are due to Mr. Hobley, who, as editor, has worked energetically to make each number of the JOURNAL worthy of the Society. What the task has been is not realised by the ordinary member, and a few words on this subject will not be out of place.

It has been the aim of the Committee to give the members, especially those who cannot make use of the Museum, something in exchange for their subscriptions paid, and one way of doing this is by the periodical issue of the JOURNAL. To keep up interest in the Society, the JOURNAL should be issued quarterly. A number of the JOURNAL contains 20,000 to 25,000 words, and the number of issues entirely depends upon the supply of matter and funds.

Are members content with two numbers? Are they indifferent as to whether they read articles and notes by the same few contributors, time after time, or not? Do they wish for variety? Then it rests entirely with them to provide it. Do they weary of the long interval between the numbers?

Improvement rests with themselves. All cannot be scribes, we admit, but those who cannot contribute to the Journal can possibly send in specimens which will be reported on by someone who can.

Members may not be aware that it costs roughly £25–£30 for each issue of the Journal, thus accounting for practically half of our income derived from subscriptions, which, taken as £1 per person, is roughly £110. Over and above this expenditure we have to pay for the rent of the Museum, meet incidental expenses, and provide Museum fittings. From this we ought also to meet the Curator's salary.

Had it not been for the generosity of Major McMillan in offering to pay the Curator's salary for one year, we would not have been in a position to retain the services of a paid Curator. The Society takes this opportunity of again thanking Major McMillan for his continued and generous support.

Special Funds.—To increase the value and interest in the Journals, the 'Illustration Fund' was started towards the end of 1915. Members were circularised and invited to contribute regularly. How many have responded can be ascertained by a glance at the Balance Sheet. It was hoped that sufficient funds would be forthcoming to meet the entire expense in connection with the increased number of half-tone blocks and coloured plates, but this has not been the case. Would members kindly consider this point?

Building.—The advisability of erecting our permanent Museum on the plot allotted to us on Kirk Road recently came up for discussion by the Committee, with the result that two schemes were put forward. It was decided that members should be consulted and asked to vote, and at the same time to contribute towards the Building Fund. Members were accordingly circularised. Comparatively few, 20 out of 108, replied to this circular and appeal.

As stated in the circular, if we have a presentable Museum of our own, placed in a prominent position, in which to display our valuable collections, increasing interest in the Society as a whole will be aroused, resulting in inevitable additions to our membership roll and automatically to our income.

The subscription list is still open, and we appeal to members to help forward the Society in this as in other matters.

The thanks of the Society are due to Dr. Pirie, who gave a public lecture in aid of the Building Fund.

Visitors.—The average number of visitors to the Múseum was roughly 20 per week.

Monthly Evening Meetings.—These have been started with a view to stimulating interest in the Society, in Natural History, and for the mutual benefit of those working on the numerous branches of Natural Science.

We have to report a marked lack of support from members, many of whom reside in Nairobi. Four lectures have been given, and reports on them published in the JOURNAL.

Collections.—Donations to the Society's collections have continued to come in steadily, with the result that our present rented building is quite inadequate for their proper display. Frequently visitors have called at the Museum to see a certain specimen some friend has sent in. They expect to find it prepared for exhibition and on view, whereas they have to content themselves with the assurance that it has been received, catalogued, and stored away in one of the numerous store-boxes which disfigure the interior of the building.

Through the generosity of Major Meinertzhagen, the Society's bird collection has benefited greatly. Major Meinertzhagen was kind enough to pay all expenses in connection with the Acting Curator's trip to Lamu and district in exchange for the Migrants which Mr. Turner collected during his stay at the coast, the Society retaining all the African species. The result has been the addition of many species which were not represented in the Society's collection. A Report on the Collection will be found elsewhere in the JOURNAL.

A list of specimens received during the year, and donors, will be published in the JOURNAL.

Curator.—Mr. A. Loveridge has been on active service during the whole year, but his place has been ably filled by Mr. Allen Turner, who is unfit for military duty. Mr. Turner's services to the Society, both as a collector and taxidermist, are well known. The Committee takes this opportunity of thanking Mr. Turner for his kindness in coming to their aid

at a critical period in the growth of the Society, and for the way in which he has discharged his duties, and also for the splendid collections he has presented to the Society. During the year the Museum has benefited greatly by Mr. Turner's skill as a taxidermist.

Library.—Several volumes have been added to the Society's Library and are available to members for reference.

Rules.—During the year the rules have been revised and altered. The amended rules will be issued to every member during 1917.

Obituary.—It is with great regret that the Committee has to record the death during the year of their late Honorary Secretary, Mr. John Sergeant, whose untiring energy against great odds helped to keep the Society alive.

Office-bearers.—The Society takes this opportunity of thanking those members who have held office during the year for their services.

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